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Cerebral Atrophy Associated with Boxing

*Karl T. Neuburger, David W. Sinton,
and John Denst*

Anatomical Studies of the Circle of Willis in Normal Brain

*Bernard J. Alpers, Richard G. Berry,
and Richard M. Paddison*

Boeck's Sarcoid Simulating a Brain Tumor

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and Murray E. Margulies*

Hemorrhagic Encephalopathy Induced by Hypernatremia

*Charles N. Luttrell
and Laurence Finberg*

Myeloradiculoganglionitis Following Zoster

G. Pálffy and A. Balázs

Observations on Current Therapy of Abscess of the Brain

*Michael P. Sperl Jr.,
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VOLUME 81

APRIL 1959

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Published monthly by the AMERICAN MEDICAL ASSOCIATION. Editorial and Circulation Offices: 535 North Dearborn Street, Chicago 10, Illinois. Publication Office: Thompson Lane, Box 539, Nashville 1, Tennessee.

Second-class postage paid in Nashville, Tennessee.

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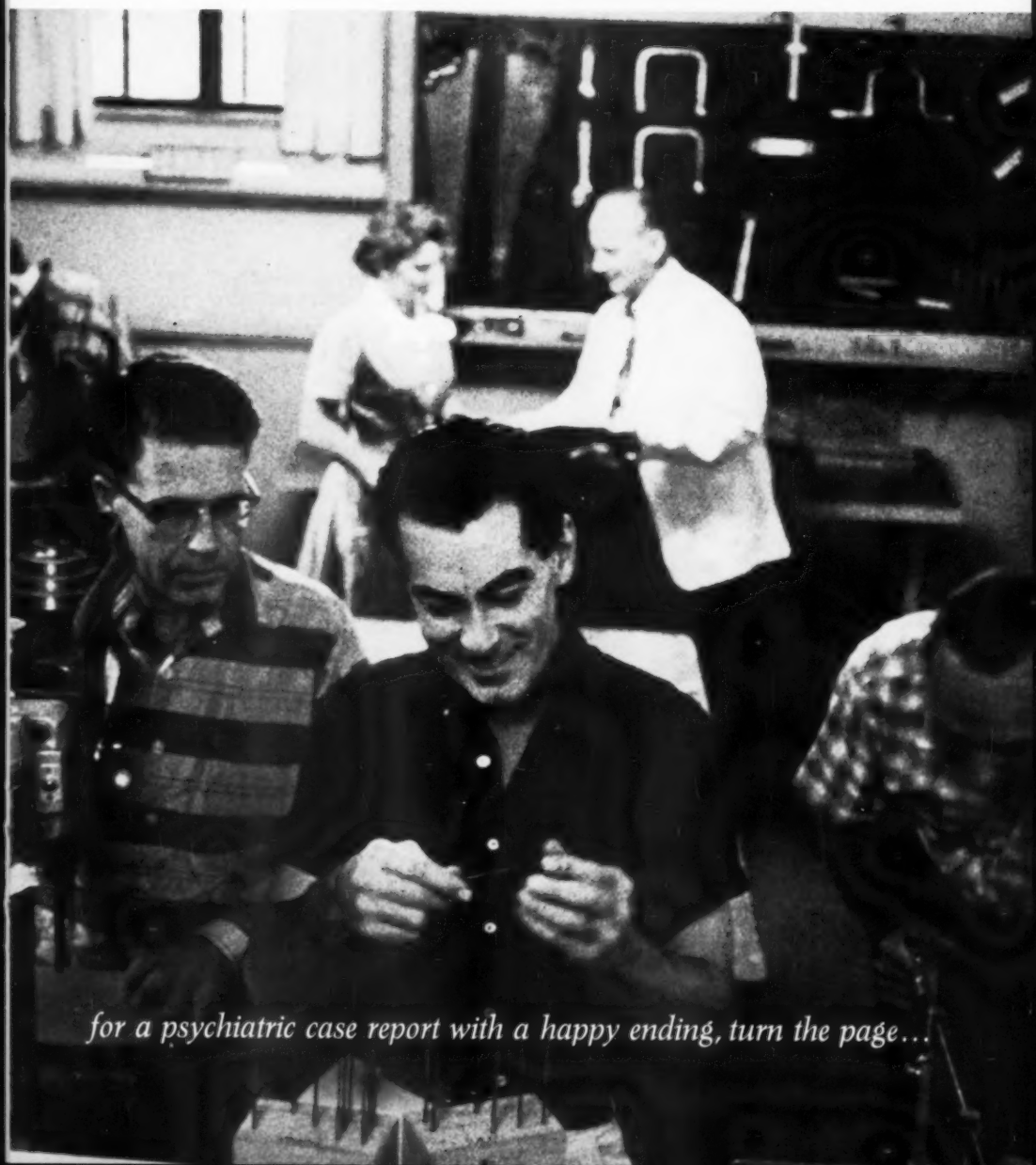
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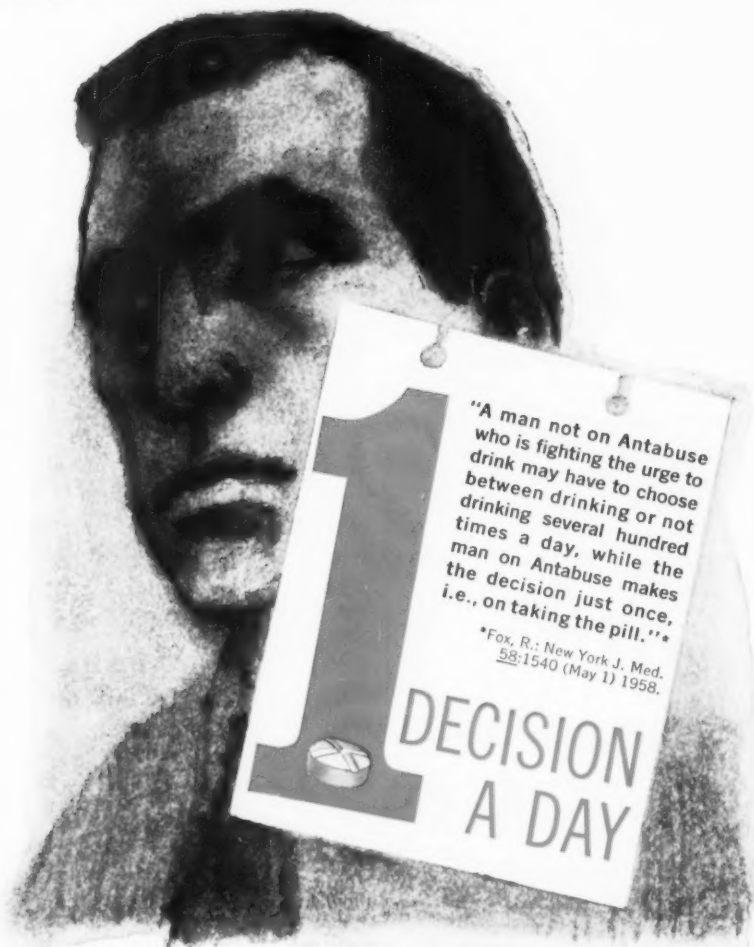
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Cerebral Atrophy Associated with Boxing

KARL T. NEUBUERGER, M.D.; DAVID W. SINTON, M.D., and JOHN DENST, M.D., Denver

In an article published several years ago in a popular magazine, Blitman¹ described the mental status of former boxers. He drew on his personal experience; he knew "what it means to be punch drunk." He vividly depicted momentary loss of coordination, brief mental black-outs, sudden waves of anger, lapses of memory, trembling hands, sharp headaches, dizzy spells, sudden jerkiness, uncontrollable shaking of the head, and ringing in the ears. The author was "one of the lucky ones," however; he "came back almost all the way physically," and his "mind remained whole." But he emphasized that "there are other men who have trouble holding onto the most menial of jobs," owing to steadily progressive physical, nervous, and mental deterioration.

More recently, Critchley² reviewed the older literature and detailed the neurologic aspects of boxing, dealing especially with "the phenomenon of groggy states as apparent during or after a contest; and the condition known as traumatic progressive encephalopathy (or punchdrunkenness)." He mentioned the paucity of pathologic data, and emphasized the desirability of additional neuropathologic studies of punch-drunk patients.

The only papers that describe the cerebral lesions in "dementia pugilistica" were published by Brandenburg and Hallervorden³ and by Grahmann and Ule.⁴ The pathologic findings in two former boxers are reported here.

Report of Cases

CASE 1.—A 46-year-old white man was seen first for a minor coronary complaint. It was noted incidentally that he was tense, tremulous, suspicious, and irritable, with some delusory phenomena. Neurologic examination revealed only paresis of upward gaze. Four years later he returned because of persistent bilateral frontal and temporal headaches. At this time a long history of boxing was elicited. He had boxed from the age of 14 to 36 and had 130 professional fights as a light heavy- or heavyweight. He was knocked out 30 times. After this, he traveled with a circus as a fighter who would "take on all comers." He claimed never to have been knocked down during this time, but was frequently "out on my feet." From the age of 50 to 53, he was observed frequently, continuing to complain of headaches, occasional black-out spells, and tremulousness. He was unable to work consistently, but held odd jobs, such as night clerk in "skid-row" hotels. Recent examinations revealed an intermittent fine, rapid tremor of the head and neck, which occasionally spread to the arms, particularly the right. A slight increase in tone was noted in the right arm, along with some decrease in ability to perform rapid alternating movements. Strength, tendon reflexes, coordination, and sensation were normal. There was a defect of upward gaze.

The electroencephalogram showed intermittent bursts of 4- to 5-second slow waves, with or without sharp waves, apparently originating in the left temporal area. Hyperventilation and photic stimulation activated these discharges. X-rays of the skull were normal. Serologic tests for syphilis were negative.

Accepted for publication May 19, 1958.

Dr. Eugene Hildebrand, Mercy Hospital, Denver, permitted the report of Case 2.

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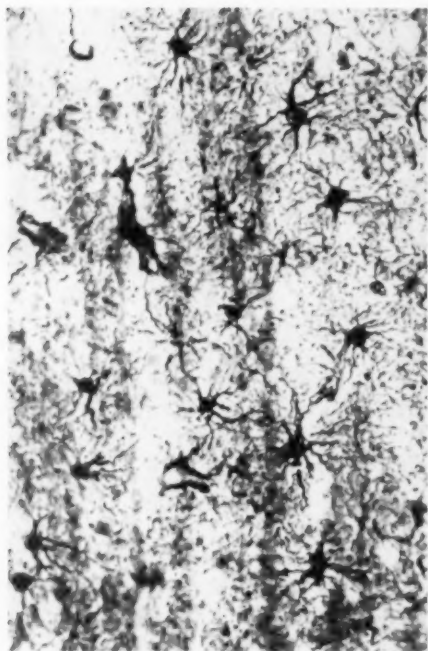


Fig. 1 (Case 1).—Deep layers of cerebral cortex, showing diffuse increase of astrocytes. Cajal stain; $\times 300$.

Simple tests of mental function showed inability to recall five digits forward, to subtract 7 from 100 serially, to perform any but the simplest calculations, and to recall presidents and dates of world wars. Psychologic tests revealed loss of immediate recall and of the ability to learn new tasks. The full-scale intelligence performance was 84.

Biopsy of Cerebral Cortex.—The lower layers of the frontal cortex exhibited a slight numerical reduction of nerve cells. A striking diffuse proliferation of large astrocytes, best shown with silver- and gold-impregnation techniques, was present in these areas (Fig. 1). Foci of astrocytes with tangled processes also were noted in the upper cortex. A suggestion of faintly argentophilic structures in the form of thin kinked fibrils was observed in the immediate neighborhood of small vessels. They vaguely resembled small "senile" plaques; however, typical plaques, fibrillary alteration, and vascular lesions were not found. Fibrillary gliosis, neutral fat, and alteration of myelin were not demonstrated.

CASE 2.—A 53-year-old white man was a boxer from the age of 18 to 24, having had 10 bouts before the age of 20. His early newspaper clippings describe him as aggressive, "always ready to give or take a punch." He fought as a middleweight, but apparently also fought heavier men. He boxed

J. S., who had the distinction of holding Dempsey to a 10-round draw. Numerous are the newspaper accounts of his staying power, i. e., his ability to win or finish the fight after having been knocked down. The first clipping in his scrapbook states that he was knocked down three times in the first round; with his left leg almost paralyzed and barely able to support his weight, he continued to receive numerous blows and was knocked down again. The fight was stopped in the seventh round. He quit the profession because of a "paralyzed left side," but tried an unsuccessful comeback one year later. He then went into business, with some success, rising to the status of independent horse raiser and motel owner.

His first known admission to a hospital was at the age of 48, for a cholecystectomy. Neurologic and personality changes were not recorded. His wife stated that during the following year he became forgetful, confused, irritable, and moody. He was examined at the Mayo Clinic, where the following observations were recorded: He was an affable, alert, restless patient, disoriented as to time and place, able to perform only the simplest calculations, and unable to find his way about Rochester unescorted. He showed an ataxic gait, decreased speed of motion in the left hand, increased tendon reflexes, and extensor plantar reflexes on the left. X-rays of the skull and electroencephalogram were interpreted as normal. The impression was "psychotic reaction—the result of organic brain disease—most likely in the nature of a traumatic encephalopathy (punch drunk)." In addition, a diagnosis of mild pulmonary fibrosis and polycythemia (Hgb, 16.8 gm. %; RBC, 5,920,000) was made.

The patient's condition deteriorated progressively. Several hospitalizations were necessary because of confusion, hyperactivity, loquaciousness, and "nervous breakdown." He died of progressive pulmonary insufficiency, having required oxygen continuously for the last few months of his life.

A careful review of all the records indicated that trauma was the only factor that might have played a primary role in the cerebral disorder. His parents had died at advanced ages, of unrelated illnesses. His brother and sister were living, older than the patient, and in good health. The pulmonary insufficiency developed about three years after the onset of the disturbance in mental function, and it did not become severe until 18 months before death.

Autopsy.—Death was due to generalized nodular pulmonary fibrosis, secondary to nonspecific interstitial pneumonitis, and chronic cor pulmonale. The embalmed brain weighed 1,130 gm. Grossly, severe atrophy was evident in the frontal lobes and was more pronounced in the right hemisphere, where it overlapped the medial aspect of the parietal lobe (Fig. 2). The convolutions were thin; the sulci

CEREBRAL ATROPHY ASSOCIATED WITH BOXING



Fig. 2 (Case 2).—Right cerebral hemisphere, showing atrophy, especially of frontal lobe.

were wide; the ventricles were slightly dilated. Focal lesions were absent. Microscopically, in conformity with the gross appearance, the severest changes were present in the cortex of the frontal lobes. However, the cortex of the temporal and occipital lobes exhibited more pronounced atrophy than was anticipated. The cortex was thinned; the stratification was partially lost; numerous nerve cells were absent (Fig. 3). Some of the remaining cells were well preserved; others showed mild to moderate chronic degenerative changes, and everywhere the cell processes were stained poorly. A suggestion of status spongiosus was seen in the upper two layers of the occipital cortex. A fairly advanced degree of gliosis was observed; many large fibrillary astrocytes were present throughout the cortex, and a network of glial fibers occupied the molecular layer (Fig. 4). The subjacent and

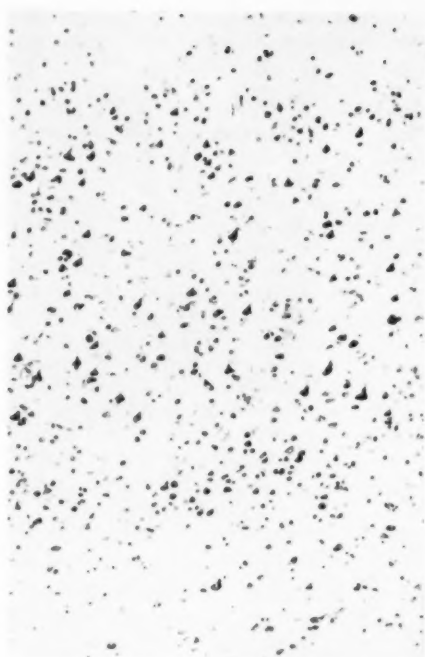


Fig. 3 (Case 2).—Atrophic frontal cortex with outfall of neurons. Nissl stain; $\times 90$.

periventricular white matter likewise showed numerous astrocytes and a considerable degree of fibrillary gliosis, which was accentuated around vessels. The hippocampus exhibited loss of nerve cells in the presubiculum, resembling that seen in senile and presenile brain diseases. The myelin-

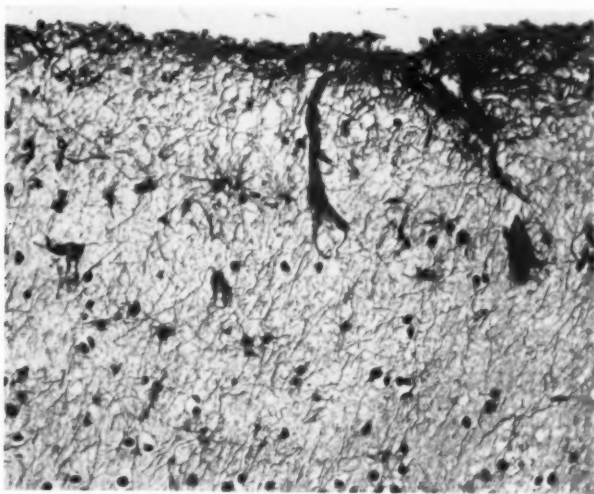


Fig. 4 (Case 2).—Fibrillary gliosis and astrocytic proliferation in frontal cortex. Holzer stain; $\times 200$.

sheath stain showed advanced loss of myelinated fibers in the diseased cortex but only slight diminution of fibers in the white matter. Lipid droplets were present about blood vessels in the white matter and were abundant in the substantia nigra. The cortical neurons contained greater amounts of lipid material than is usually seen at this age. There were no vascular lesions, senile plaques, fibrillary alterations of nerve cells, or intracellular argentophilic inclusions. The thalamus exhibited a mild plasmatic gliosis, but the number of nerve cells here, and in the lenticular nuclei as well, was normal. The myelin pattern throughout the midbrain, pons, and medulla was normal except for a small patch of paling in the approximate center of the basis pontis. The pyramids showed severe fibrillary gliosis, more advanced on the right side. The cerebellum exhibited a slight reduction in the number of granule cells.

Comment

Mental deterioration in boxers, as described by Critchley² and others, would be expected to have an anatomical basis, and the findings in these cases correlate with the clinical abnormalities. The pathologic picture in the fatal case was that of a diffuse atrophy of the brain, accentuated in the frontal lobes. The gross appearance was suggestive of Pick's disease. The microscopic pattern was compatible with this diagnosis, although swelling of cortical nerve cells and argentophilic inclusions were absent, and there was definite involvement of the occipital cortex. The first case was of limited value with regard to the broad evaluation of the pathologic process; only a biopsy specimen was available, and the patient is still alive. There was clinical and electroencephalographic evidence of slowly progressive mental deterioration. Mild loss of cortical neurons with definite plasmatic gliosis, particularly in the deeper zones, was observed. Plaques and fibrillary alteration could not be demonstrated unequivocally. Future progression to diffuse atrophy, as in Case 2, seemed to be a reasonable possibility.

One could say that these cases are instances of peculiar presenile atrophy of the brain, perhaps atypical Pick's disease, which occurred in former boxers by coincidence. This interpretation is understand-

able, and perhaps not fully refutable, but there are weighty factors that militate against it, especially when the cases described by Brandenburg and Hallervorden³ and by Grahmann and Ule⁴ are considered.

Brandenburg and Hallervorden's³ case was that of a boxer who had fought from the age of 18 to 29, and who developed progressive dementia and Parkinsonism at the age of 38. He died at the age of 51 of massive right intracerebral hemorrhage, without arteriosclerosis or hypertension. The brain showed atrophy with severe argentophilic (*drusige*) degeneration of vessels, unusually large numbers of senile plaques, and widespread fibrillary alteration of nerve cells. The findings were interpreted as a special form of post-traumatic dementia with Parkinsonism and delayed traumatic apoplexy. The case was not considered to be an ordinary instance of Alzheimer's disease. This interpretation was criticized on the basis that such a single case might be no more than an accidental association of boxing with Alzheimer's disease. The critics emphasized that many years had elapsed after the termination of boxing before the clinical picture became apparent. These objections lost much of their substance when Grahmann and Ule⁴ published the case of a man who had boxed from age 15 to 25 and at the age of 46 had developed a dull-euphoric dementia, with poorly defined focal symptoms, extrapyramidal disturbances, and progressive external and internal hydrocephalus. He died at the age of 48, with a hemorrhagic infarction of the right frontal and parietal regions, due to thrombosis of dural sinuses and meningeal veins. (This lesion was ascribed to pneumoencephalography and to unusually severe summer heat.) The brain showed atrophy without plaques, but with fibrillary alteration, chiefly in the mesencephalon and metencephalon, but also in the cerebral cortex and diencephalon. Old foci of contusion were absent. The authors felt that the term "dementia pugilistica" should be reserved for cases of chronic progressive disorders developing after a symptom-free interval,

and that neurologic disturbances arising in immediate connection with head injuries should be called traumatic encephalopathy of boxers. To our knowledge, these are the only previously reported cases of progressive mental deterioration in boxers in which histologic examination has been undertaken.

While our cases failed to reveal argento-philic changes, undoubtedly they belong in the group of senile and presenile cerebral involutions (senile brain atrophy, Pick's and Alzheimer's diseases). The mechanism of involution is understood best with the help of von Braunmühl's⁵ theory on the process of aging of the colloids of the brain. This process is characterized by diminution in the degree of dispersity of the colloids and by the separation of the medium of dispersion into two phases of different colloidal content, one of which consists of concentrated colloid with little water, and the other of a thin, watery medium with little colloid. The progressive separation of colloids and water, known as syneresis, was supposed by von Braunmühl to take place in the brain. The dehydrated and shrunken gels are capable of swelling (*Quellung*) to some extent, indicating a partial reversibility of syneresis. Nevertheless, complete reversion to the normal state of the colloids is not achieved, and reversibility tends to decrease as involution proceeds; this partial irreversibility is termed hysteresis. In the aging brain, the primary syneretic process results in atrophy, condensation of tissue, dehydration, and formation of catabolic products. The secondary phenomena of precipitation and swelling (*Quellung*), leading to plaque formation and fibrillary alteration respectively, may or may not ensue. *Plaquesfähige* substances, the precursors of plaques, may be present without being precipitated, and hence not demonstrable with silver methods. This was elucidated convincingly by von Braunmühl, and is borne out by the not-infrequent occurrence in all types of involutional brain disease of some cases without argento-philic substances. The absence of argento-philic substances in our

cases, therefore, does not exclude them from the group of involutional brain diseases. Discussion of other theories of plaque formation and its possible relation to amyloidosis is beyond the scope of this paper.

The pathogenesis of the traumatic lesions in our cases may be explained in accordance with the views of Brandenburg and Hallervorden and of Grahmann and Ule, which were predicated on von Braunmühl's theory. These authors believed that the cerebral alterations are thixotropic in origin. Thixotropy, a term used for a long time in colloid chemistry, is the disturbance of the gel-sol equilibrium caused by shaking, stirring, ultrasound, or other mechanical factors. Concussion produces a change in the colloid medium of the cerebral tissue, according to Hallervorden.⁶ Boxers may be subject to repeated concussions that, although often subliminal, may be assumed to incur sequelae. This supposition is substantiated by demonstrable electroencephalographic abnormalities in boxers, as discussed thoroughly by Pampus and Grote.⁷ More recently, Hallervorden and Quadbeck⁸ have stressed that concussion involves all of the brain and not merely circumscribed areas, such as the brain stem, which, for a long time, was considered to be of special importance because its irritation may result in unconsciousness. The writers noted, however, that the brain stem is relatively well protected as a result of its deep location and its cushioning by the spinal fluid. It is also phylogenetically old, and therefore a less vulnerable part of the brain. They supported Denny-Brown's⁹ opinion that concussion is the direct result of a generalized mechanical injury to the cells of the brain. Trauma may produce an immediate alteration of protoplasm, such as liquefaction of gels, which may or may not be reversible. It is conceivable that multiple, partly subliminal concussions, repeated over a period of years, produce an altered state of the cerebral colloids, with inability to revert to the normal equilibrium. This process leads to precocious aging of the

colloids; fluid is liberated, with shrinkage of the gels. In the course of events, it becomes ever more unlikely that the contracting gel will resume its original hydrated state. Syneresis and hysteresis will prevail.

It is apparent, therefore, that the involutional processes presumably initiated in the brains of boxers by trauma are intimately related to those of senility and presenility. If this is true, it is not surprising that cases resembling both Pick's and Alzheimer's diseases have come to attention in association with boxing.* Of course, other factors cannot be divorced from pathogenetic concepts. The circulatory disturbances incident to concussion, with resulting acidosis, increased vascular permeability, and edema, are of significance, especially when they occur time and again in a previously damaged brain.

Summary

While neuropsychiatric complications in boxers are well known and subject to increasing interest, the cerebral pathology has not been fully explored, particularly with regard to the late sequelae.

Two patients with the symptoms of dementia pugilistica were studied.

Cerebral cortical biopsy in one case revealed mild neuronal degeneration and definite plasmatic gliosis in the lower cortex.

The brain of the other patient was severely atrophic, presenting a picture which grossly and microscopically resembled Pick's disease.

* The role of head trauma as a contributing or an activating factor in the development of Pick's disease has been discussed by van Mansvelt.¹⁰ We are aware of the fact that the clinical picture in our case was not identical with that of Pick's disease.

As in other cases, the disease became manifest some years after cessation of professional boxing.

In the absence of focal lesions, the pathogenesis is explained best on the basis of a thixotropic process, leading to premature aging of the brain.

These cases emphasize the complexity of the pathologic processes and the desirability of careful examination of the brains of former boxers.

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Anatomical Studies of the Circle of Willis in Normal Brain

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Introduction

The present study was undertaken in order to determine the anatomical structures of the circle of Willis,²⁷ with the purpose of learning its normal configuration, the frequency of deficient or incomplete circles, and, if possible, how these findings can be correlated with the clinical problems of vascular disease, such as infarcts, aneurysms, and vascular anomalies.

There are many problems in vascular disease of the brain which make desirable an intimate knowledge of variants in the anatomy of the circle of Willis. The state of the circle becomes important in determining the adequacy of the brain circulation in operations for cerebral aneurysm and in ligation of the carotid artery. The possibility of bypassing or shunting effects in occlusion of one of the cerebral vessels and the adequacy of recovery or lack of recovery after vascular occlusion might be explained in part by variations in the anatomy of the circle of Willis. The failure in some instances of vascular occlusion to recover at all, and the recovery in others over a long period of time—may these outcomes be associated in part with anatomical variations of the circle? These, and other related, problems make a study of the circle of Willis in the normal brain essential.

It is proposed to limit the present discussion to the anatomical variations in the circle of Willis in normal brains. The main feature of the present report—indeed, its primary and most important feature—is the anatomical description of the circles.

Received for publication April 22, 1958.

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Materials and Methods

The circle of Willis was examined *in situ* after formalin fixation in each brain received in the neuropathology laboratory from the autopsy service of a general teaching hospital.

The circles were examined in the fixed brain, described, and a rough drawing made of each. The entire circle was then removed and photographed on a 1:1 size basis after fastening it to a paraffin plate. The circles were then preserved in formalin.

Of the total of 837 brains available for analysis in the six-year period, 463 showed no macroscopic evidence of intracranial disease. Of this number, 113 were discarded because of inadequate description of the circle.* The data presented herein are thus derived from a population of 350 selected brains in which no gross evidence of vascular pathology (except for arteriosclerosis) or other disease was present (Table 1).

TABLE 1.—Data on 837 Brains Examined

Tumors.....	105
Vascular disorders.....	225
Miscellaneous.....	44
Normal gross brains.....	463
Discarded.....	113
Population in this survey..	350

The normal, or "textbook," polygon, or circle, of Willis is defined for present purposes as a closed circuit in which, by means of the component vessels, fluid may circulate from any entrance point, to return to that point of entrance, with the component vessels of the mature brain more than 1 mm. in outside diameter, with no excess vessels, and with the usual paired anterior cerebral arteries. Variations in diameter between symmetrical component parts were not considered to be abnormal if the smaller vessel was over 1 mm. in outside diameter. The one exception was the large

*Of those circles discarded as inadequately described, 56% were from newborn, premature, or stillborn infants, and 26% were damaged, so that description could not be accurate. The remainder were lost or were not described for unknown reasons.

posterior cerebral vessel, derived from the internal carotid artery, thus preserving the embryonic relations.

In general, in the mature circle of Willis the relationship described by Padget¹⁸ was considered the "normal" configuration of the polygon: The anterior communicating artery is one-half to two-thirds the size of the anterior cerebral artery, which, in turn, is one-half the size of the internal carotid artery. The posterior communicating artery is one-half the size of the posterior cerebral artery, which is one-half the size of the basilar artery. Actual measurements of external diameters were not made routinely, except in the case of thread-like or string-like vessels. When indicated, individual vessels were examined with the dissecting microscope to verify macroscopic impressions. Selected vessels were mounted in paraffin and stained appropriately for microscopic detail.

Results

The abnormalities of the circles were tabulated according to the various deficiencies and the combinations of these deficiencies in component vessels. The material was grouped into two main classes: (1) normal circles; (2) deficient circles. The terms normal and deficient apply to anatomical features of the circle and have nothing to do with functional description (Table 2).

TABLE 2.—Circle of Willis in Normal Brains (Total Brains 350)

	Single Anomaly		Combined with Other Anomalies	Total
	Unilateral	Bilateral		
Normal	--	--	--	183 (52.3%)
Absent vessel	2	0	0	2 (0.6%)
Fusion anterior cerebral	5	--	1	6 (1.7%)
String-like vessels	33	21	42	96 (27.4%)
Accessory vessels	29	0	37	66 (18.9%)
Anomalous origin	16	13	22	51 (14.6%)
Multiple anomalies	--	--	47	47 (13.4%)
	85	34		

I. Normal Circles

Of the 350 circles of Willis which form the basis for this study, slightly over one-half, or 183 (52.3%), were found to be normal in anatomical configuration. Slight variations in symmetry of the polygon were

ignored so long as the circle was complete. The degree of arteriosclerosis[†] was not considered so long as no gross infarcts were present in the brain. The numerous variations in the arteries supplying the cerebellum and the pons and medulla, as well as variations in the vertebral arteries, are not considered germane to the present report, and if the Willisian polygon was normal, the basilar and vertebral asymmetries were ignored.

II. Deficient Circles

A. Absent Vessels.—1. Left Posterior Communicating Artery: This artery was absent in two circles (0.6%) in which an adequate segment of the internal carotid artery warranted the assumption that such an absence was not an artifact. In addition to the adequate preservation of the proximal portion of the internal carotid artery, both that vessel and the posterior cerebral artery were examined with a dissecting microscope to be certain that no evidence of a torn vessel could be found (Fig. 1).

2. Anterior Communicating Artery: Strictly speaking, the anterior communicating artery was absent in 6 (2%) of the circles included in this analysis, but the circle was completed by a fusion of the two anterior cerebral trunks for a variable distance. In no case was there absence of an anatomical connection between the right and the left anterior cerebral artery. The length of the single fused vessel in these six cases

[†] It is recognized that this selection fails to take into consideration a potentially important factor: the narrowing of the lumen by atheromatous plaques. Such an analysis will form the basis of another study.

Fig. 1.—Absent vessel.



2 left posterior
communicating arteries
0.6%

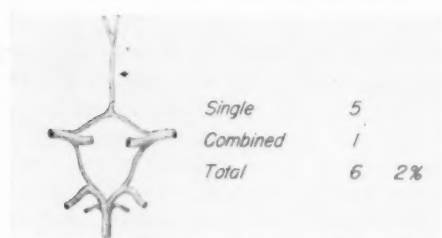


Fig. 2.—Fusion of anterior cerebral arteries 0.3 to 3.9 cm.

varied from 3 to 39 mm. (Fig. 2). One anomalous circle with fused vessels had combined abnormalities; in five circles the fusion was the only anomaly.

B. String-like Vessels.—The commonest anomaly was a reduced size of one of the component vessels to below 1 mm. in external diameter, an arbitrary figure used to describe string-like or thread-like vessels in adult brains. Such attenuated vessels alone or in combination with other anomalies occurred in 96 circles (27.4%).

1. String-like Posterior Communicating Artery: Of these string-like vessels, the most frequent to occur was the posterior communicating artery (22%) on one or both sides, either alone (14%) or in combination with other anomalies. As a single anomaly, there were 28 circles (8%) in which either the right or the left posterior communicating artery was string-like. This anomaly was present on the right side in 12 circles and on the left side in 16 circles (Fig. 3).

A further 21 circles (6%) presented as the only anomaly bilaterally symmetrical string-like posterior communicating arteries.

These string-like connections between the internal carotid and the vertebral sources of blood supply to the brain were associated

Fig. 4.—String-like anterior communicating artery.

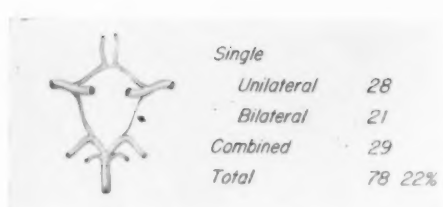
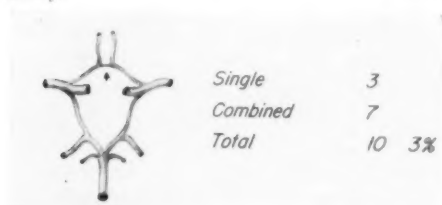


Fig. 3.—String-like posterior communicating artery.

with other anomalies in 29 further circles ("Multiple Deficiencies"). The posterior communicating vessel was thread-like on the right in 10 of these and on the left in 9; in the remaining 10 specimens the posterior communicating vessels were symmetrically string-like on the two sides.

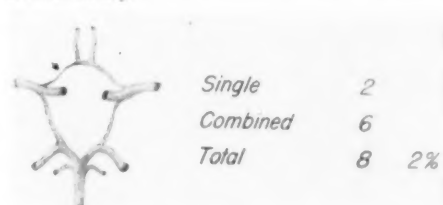
2. String-like Anterior Arteries: Other component vessels of the Willisian polygon were string-like in its anterior half.

(a) The communication between the right and the left carotid circulation, the *anterior communicating artery*, was less than 1 mm. in external diameter and was present as a single anomaly in three circles (Fig. 4). In seven other circles this vessel was string-like in combination with other anomalies.

(b) The *anterior cerebral artery*, in that portion extending from its origin at the internal carotid to the anterior communicating vessel ("proximal portion of anterior cerebral") had an external diameter of less than 1 mm. in two circles as the only anomaly, and in a further 6 circles as a combined abnormality (Fig. 5).

3. Patency of String-like Vessels: Although these attenuated arteries had a small external diameter, the overwhelming majority were found to be patent vessels when

Fig. 5.—String-like proximal portion of anterior cerebral artery.



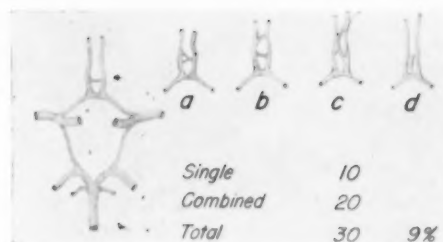


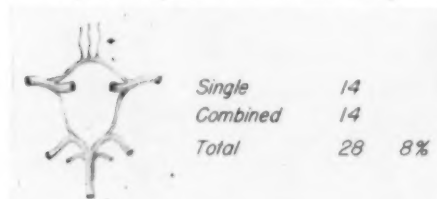
Fig. 6.—Accessory anterior communicating artery.

examined in cross section, either macroscopically or with a dissecting microscope, with one exception: an arteriosclerotic circle which had a lumen occluded by proliferated intima, macroscopically, but in which, nevertheless, on microscopic examination a minute patent lumen was found.

C. Accessory Vessels (Duplications and Triplications).—In 66 circles (18.9%) there were duplications or triplications of vessels forming the polygon or of major vessels immediately derived therefrom. The vast majority of these duplications were in the anterior portion of the circle—in the anterior cerebral and anterior communicating arteries.

1. Anterior Communicating Artery: Accessory vessels were present in 30 circles as variations in the usual arrangement of the *anterior communicating artery* (Fig. 6). Such an anomaly might be a simple duplication, with two parallel vessels connecting the anterior cerebral arteries. Often one of these was an attenuated, but patent, vessel, perhaps one-third to one-half the diameter of its mate. Such parallel duplications occurred in about two-thirds of the specimens. A midline connecting vessel between these two parallel, duplicated anterior com-

Fig. 7.—Triple anterior cerebral artery.



municating arteries was frequently present. A forked anomaly with a bifid anterior communicating artery was present in four specimens, with no predominance as to which side the bifurcation pointed. These anomalies occurred more frequently with other abnormalities of the circle of Willis (20 specimens) than as a single anomaly (10 specimens).

2. Triplicate Anterior Cerebral Artery: The two normal anterior cerebral arteries were accompanied by a midline third anterior *cerebral vessel*, arising from the anterior communicating artery in 28 circles of Willis in this series of normal brains. This anomaly occurred with equal frequency as the only abnormality in 14 cases and combined with other anomalies in 14 (Fig. 7).

When such a triplicate anterior cerebral artery was present, the middle aberrant ves-

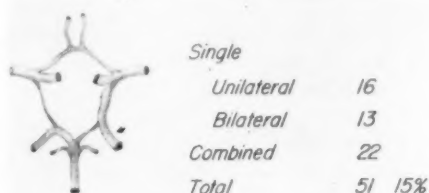


Fig. 8.—Posterior cerebral artery from internal carotid artery.

sel was usually about the same diameter as the right and left anterior arteries. This middle artery followed the corpus callosum to the level of the paracentral lobule, where it divided into branches supplying the precuneus and the parieto-occipital sulcus on either side. In general, the laterally placed "normal" anterior cerebral arteries supplied only the anterior two-thirds of their respective territories.

3. Other Accessory Arteries: The remaining eight accessory vessels were a duplicated loop of the proximal portion of the anterior cerebral artery, in three circles; an aberrant early bifurcation of the middle cerebral artery at the termination of the internal carotid artery in the pyriform fissure, in two circles; a forked posterior

communicating artery, in two specimens, and a duplicated posterior cerebral artery, in one specimen.

D. Anomalous Origins.—1. Embryonic Origin of Posterior Cerebral Artery: The embryonic derivation of the posterior cerebral artery from the internal carotid artery persisted as an anomaly in 51 circles (14.6%) (Fig. 8). Such a vessel was connected by a small branch to the basilar artery. It was present as a bilateral symmetrical abnormality in 13 specimens; it was present on one side only in 16 (right, 9; left, 7). In 22 further circles this derivation of the posterior cerebral from the internal carotid artery was associated with other anomalies. Of these, 13 were on the right side and 9 on the left; none was bilateral.

E. Multiple Deficiencies.—Those circles in which a single vessel was anomalous totaled 85 (24.3%). If, as seems more logical, we include in the category of single anomalies those bilaterally symmetrical abnormalities of the posterior communicating artery, that is, either those which were string-like or those which preserved the embryonic derivation of the posterior cerebral from the internal carotid artery, there were 119 (34%) circles with single anomalies (Table 2).

Combined anomalies in individual circles occurred in only 47 cases (13.4%) if, again, we consider the bilaterally symmetrical posterior communicating anomalies as a unit.

For the most part, these multiple deficiencies consisted of two anomalies (in 41 of the circles). More than two anomalies were combined in six circles (1.7%), one of which contained five anomalous vessels;‡ the remaining circles were limited to three anomalies per circle.

‡ There were string-like right posterior communicating and right proximal anterior cerebral arteries, a persisting embryonic derivation of the right posterior cerebral artery from the internal carotid, a duplicated anterior cerebral artery on the right, and a duplicated anterior communicating artery.

1. In the series of string-like vessels, 44% were encountered in combination with other anomalies. In order of frequency, these combinations were with the embryonic derivation of the posterior cerebral artery, with a duplicated anterior communicating artery, with other string-like vessels, and with three anterior cerebral arteries.

A string-like posterior communicating artery occurred almost as frequently as a combined bilaterally symmetrical anomaly (21 circles) as a unilateral anomaly (28 circles). A combination with other anomalies was present in a further 29 circles—most frequently with a duplication of vessels in the anterior half of the circle (12 circles) or with a posterior cerebral artery of embryonic origin (10 circles), in one-half of which cases the combined anomaly was on the opposite side.

2. Vascular duplications were combined with other anomalies more frequently (55%) than as single anomalies (45%). In descending frequency, these combinations were with string-like vessels, with other duplications, and with embryonic derivations of the posterior cerebral artery.

3. The persistence of the embryonic derivation of the posterior cerebral artery from the internal carotid artery was slightly more frequently a single anomaly (16 cases) than a bilaterally symmetrical anomaly (13 cases). In addition to association with an anomalous origin on the opposite side, in 22 cases (43%) these embryonic vessels were associated with other variations from the normal. This combination was most frequently seen with string-like vessels or duplicated vessels. Of the combined cases, all were of unilateral embryonic origin, and the most frequent string-like vessel was the posterior communicating artery, occurring equally on the same and on the opposite side as the anomalous posterior cerebral artery.

Multiple vessels, except the combination of triple anterior cerebral and duplicated anterior communicating arteries, were rarely associated with other vascular duplications.

TABLE 3.—*Anomalies of Individual Vessels*

	Normal	Abnormal
Posterior cerebral arteries	298 (85.1%)	52 (14.9%)
Posterior communicating arteries	268 (76.6%)	82 (23.4%)
Internal carotid-middle cerebral arteries	348 (99.4%)	2 (0.6%)
Anterior cerebral arteries	307 (87.7%)	43 (12.3%)
Anterior communicating artery	304 (86.9%)	46 (13.1%)

and thus were found more commonly in the anterior part of the circle.

F. Variations of Individual Vessels (Table 3).—1. Posterior Cerebral Arteries: Normal paired posterior cerebral arteries arising from the bifurcation of the basilar artery occurred in 298 of 350 circles of Willis. The commonest anomaly (51 circles) was the persistent embryonic derivation of this vessel from the internal carotid artery. There was one instance of duplication, actually an early branching of the posterior cerebral artery as it arose from the normal bifurcation of the basilar artery.

2. Posterior Communicating Arteries: Normal paired posterior communicating arteries connecting the internal carotid artery with the posterior cerebral, or connecting the posterior cerebral, when derived directly from the internal carotid, with the basilar artery, occurred in 268 of the 350 circles. The most frequent anomaly (78 circles) was a string-like vessel. A duplication or forking of the posterior communicating artery was present in two circles, and this artery was absent in two circles.

3. Internal Carotid-Middle Cerebral Arteries: In two brains, there was an early branching of the middle cerebral artery, as an aberrant, or "duplicated" vessel.

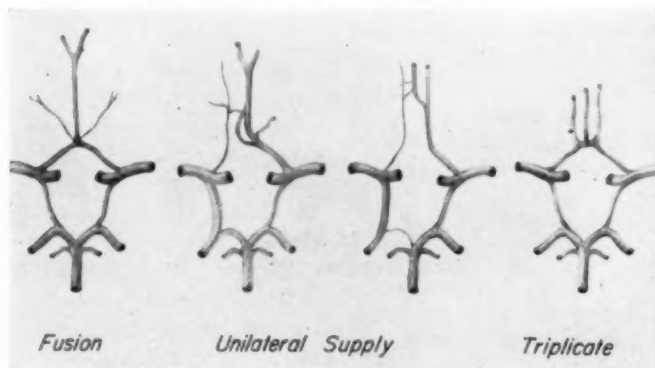
4. Anterior Cerebral Arteries: Normal paired anterior cerebral arteries were present in 307 circles, an anomaly occurring in 43 (Fig. 9). The abnormalities were predominantly accessory vessels, with triple anterior cerebral arteries in 28 circles and duplicated vessels in 3 circles. Fusion of the anterior cerebral arteries to form a single vessel occurred in six circles. A string-like proximal portion of the anterior cerebral artery was present in eight circles.

5. Anterior Communicating Artery: Normal connections between the two paired anterior cerebral arteries were present in 304 circles; anomalies, in 46. Accessory anterior communicating arteries accounted for 30 abnormalities; string-like vessels occurred in 10 circles, and a communication by fusion of the anterior cerebral arteries, rather than by a communicating artery, occurred in six circles.

Comment

A comparison of the various collated figures with the present group is only approximate. Several descriptions of the circle of Willis have included only those brains with aneurysms (Wilson, Riggs, and Rupp²⁸; Slany²³; Padget¹⁸), only those with vascular lesions within the brain

Fig. 9.—Anterior cerebral artery variations.



(Saphir²²; Stopford²⁴), apparently selected cases of anomalies (Leidy¹⁴), or unselected brains, including those with vascular lesions and tumors (Riggs et al.²⁰).

There is little unanimity in nomenclature in the variations from the textbook normal pattern of the polygon of Willis, which are described individually in many reports, or in the several series of circles, which number from 50 to over 1,000. The incidence of normal varies with the interpretations of the analyzers, some of whom include slight to moderate variations in symmetry of the circle as anomalies. The recorded incidence of anomalies thus varies through a wide range. Base line statistics of normal brains with which to compare a series of aneurysms or cases with vascular disease are difficult to find.

Padgett¹⁸ summarized the major contributions to the literature concerning anomalies of the circle of Willis. She was able to collect 1,803 partial or complete descriptions of the polygon. Barely half of the collected cases were "textbook-normal" in configuration, although the range varied from 11% (Fawcett and Blachford⁷) to 73% (Hasebe¹¹). In the present series, the incidence of normal circles is 52.3%.

The incidence of *absent vessels* resulting in an incomplete circle, which was found to be 0.6% in this group of normal brains, varies in the literature. Several authors, such as Duret,⁵ de Vriese,⁴ and Riggs,²⁰ have found none absent. When absent vessels were reported, they were usually in the position of the posterior communicating artery. Godinov⁹ was doubtful of the one specimen in his series of 100. Fawcett and Blachford,⁷ in 700 autopsies, found an incidence of 3.8%; Stopford,²⁴ 5.4%, and Fetterman and Moran,⁸ 5%. Windle,²⁹ who reported anterior cerebral arteries absent in 2, and posterior communicating vessels absent in 25, of 200 circles, noted that "when one or both arteries were absent, there was not always a complete want of communication between the two sides. On the contrary, in the majority of cases, there was a slight anastomosis in the inter-

peduncular space between small twigs passing from the basilar and carotid to the base of the brain in that position." On the basis of her collation, Padgett¹⁸ considered the most frequent site of anomaly to be in the posterior half of the circle.

However, given healthy vessels, the most important anatomical factor in reference to potential collateral circulation may be the actual presence, rather than the size of the component vessels. In the three largest series of adult cases without aneurysms in the literature, an uninterrupted circle occurred in 92%.

Riggs,²⁰ however, in reviewing 1,647 autopsies, plus "thousands subsequently examined," has failed to find a case of actual absence of a component vessel. She and others have noted that careful search will usually demonstrate small anastomosing twigs. From our experience, in many circles which superficially show no communication between the major arteries, on careful examination the absence can seriously be questioned as a probable artifact, for a torn nubbin can usually be found in the anticipated point of junction. Such tears result from careless or inexperienced removal of the brain and are also secondary to the common occurrence of fragile filiform communicating vessels in this region. It is, of course, impossible to say whether such vessels were twigs or filiform branches, but evidence of their former existence is present on close examination. In order to obviate inclusion of such an artifact, the circles of Willis with absent or string-like vessels in the present series were repeatedly and independently examined by separate observers, the dissecting microscope being used when necessary.

If the origin of the posterior communicating artery was severed in the process of removal from the calvaria because of inaccurate cutting, the specimen was discarded. If, for any reason, the vessel was torn in such a way that the circle could not be reconstructed by an independent observer, such a specimen was also discarded from the series. It could occasionally be assumed that an apparently absent vessel must have been torn, because, under the dissecting

microscope, a nubbin of tissue or a lumen was present on the parent vessel. Under such circumstances, again, the specimen was discarded from the series. The present series is weighted by such a selection of circles, from which were eliminated as inadequate approximately one-third of the available material. It is conceivable that examples of absent vessels were in the discarded specimens, but, because of the factors mentioned, there exists a reasonable question whether such absence may be an artifact. The series is likewise weighted because the specimens of many premature and newborn infants, traumatized in the process of removal, were discarded.

It must be assumed, therefore, that the figures given in the present series for absent and string-like vessels are minimum values because of such strict criteria for discarding specimens. It would appear reasonable that the smaller, more delicate vessels would be more easily torn.

The incidence of anomalies in general follows that recorded in the literature. Although the terminology is somewhat different from the collection made by Padget,¹⁸ the present series follows fairly closely that previously found, with the exception of the absent vessels.

The reported occurrence of *string-like vessels* varied from 4% to 46%. In the present group, it was 27%. Several authors have assumed that these vessels are fibrous strands of atrophied vessels, but a random sampling of one-third of the present series demonstrated a patent lumen, even in the most attenuated vessel.

Padget¹⁸ tentatively suggested that the string-like or attenuated vessels might be more frequent in the brains of older persons. We were unable to verify this in a statistical analysis of either Hasebe's¹¹ or our own cases. The present series showed no predilection for a particular age group. The median age was 50, the ages ranging from newborn infants to 88 years.

The usual site of string-like vessels, as others have noted, is one or both posterior communicating arteries, these accounting

for 81%. The proximal anterior cerebral location accounted for 9%, and the anterior communicating artery for 10%, of the attenuated vessels.

In general, variations in the anterior communicating and anterior cerebral vessels have been described only as "common" or "very common"; Riggs et al.,²⁰ de Lima,¹⁵ and Busse³ recorded several variations, as did Padget.¹⁸ The incidence of poor communications between the two anterior cerebral arteries is difficult to determine. Padget,¹⁸ in her collection, considered them normal in 68% of 1,803 brains, with adequate communication in about 90%. Riggs et al.,²⁰ from her illustrations, apparently found "hypoplastic" variations in the proximal portion of the anterior cerebral commoner than in the anterior communicating arteries.

Duplicated vessels in the communication of the anterior cerebral trunks are common, although actual figures are difficult to find; those available range from 4% to 25% (9% in ours). The persistence of the midcallosal branch, or triple anterior cerebral artery, varies widely in reported incidence, although found as low as 3%. De Almeida¹ reported its occurrence in 10 of 50 circles, and de Vriese⁴ found a 41% incidence. Such a triple anterior cerebral artery was present in 8% of this series.

Fusion of the anterior cerebral arteries was present in de Vriese's⁴ infant brains in two cases, a total of 1.8%, as compared with 1.7% in the present cases and less than 1% in Kleiss'¹² series.

De Vriese,⁴ as well as Padget,¹⁹ have investigated the embryology of the circle of Willis, and from their studies the common occurrence of anomalies in the anterior communicating vessel is easily appreciated. In keeping with the embryologic dictum that the first evidence of anastomoses between larger vascular trunks is a plexus of vessels, the residual anomalies from the primitive anterior cerebral plexus is not unexpected.

It is indeed the correlation of embryologic data with the anomalies discovered that has

been one of the more interesting features of this study. The vessels of supply to the brain develop from such a primitive plexus of vascular channels, with an "elaboration of certain channels and the comparative or total disappearance of others . . . in accordance with contemporary needs and relations of the areas to be supplied."¹⁸ Until approximately the 14-mm. stage in the human embryo, all the cerebral arteries are supplied primarily by the carotid system. Blood supply to the primitive head ganglion of lower forms is exclusively from the paired vertebral arteries.^{4,10,16,25} It is only with the advent and development of the primitive forebrain that the carotid circulation becomes important. The posterior cerebral artery, initially a branch of the internal carotid artery, only late in development becomes derived primarily from the vertebral-basilar supply.

It is the preservation of the large (primitive) connection of the internal carotid with the caudal portions of the encephalon that accounts, presumably, for the "embryonic derivation" of the posterior cerebral artery from the internal carotid, parent vessel as a fairly common anomaly, found in 15% of the present series, with a maximum of 40% in Hasebe's,¹¹ and of 29% in Padget's,¹⁸ collection from the literature.

It would be tempting to explain the attenuated, thread-like or string-like posterior communicating artery on the basis of "atrophy" of the vestigial connecting branch, possibly being able thus to correlate such atrophy with the aging process, as Padget¹⁸ has hinted. As noted above, such an explanation does not readily coincide with the observed facts.

The present study does confirm in general the previous impressions of a difference between the anterior and the posterior half of the circle in respect to type of anomaly. Most of the variations in the posterior half are either string-like arteries or persistent embryonic derivations of the posterior cerebral arteries, factors which conceivably have significance in relation to cerebral

blood flow. The anomalies of the anterior circle are overwhelmingly those of duplications or accessory vessels.

The functional significance of the anomalies of the circle of Willis cannot be stated with certainty. Evidence from pathological studies, and from arteriography in instances of occlusion of the internal carotid artery in particular, indicates that collateral circulation becomes important in occlusive vascular disease of the brain. Such collaterals develop chiefly through the pial vessels and the circle of Willis. Under such circumstances, it is reasonable to assume that compensatory circulation will be more effective in the presence of an intact circle of Willis than in one in which deficiency is present. Probably most important for the establishment of collaterals through the circle of Willis are the posterior communicating and the anterior communicating arteries. If the posterior communicating artery of one side is absent or is string-like, in the presence of an occlusion of a major vessel of the opposite side, collateral circulation through the anterior and posterior segments of the circle may be impaired, possibly seriously. The likelihood of impairment through the anterior communicating arteries is not so great, since the present study indicates that an absent anterior communicating artery is rare and duplications and triplications are not uncommon. The connections between the internal carotid and vertebral-basilar systems are therefore important in the establishment of collateral circulation, just as are those between the two sides of the circle of Willis. The present study does not indicate how collaterals become established. This remains to be determined.

Summary

The circle of Willis is analyzed in a selected series of 350 normal brains, with the following findings:

1. A normal configuration of the polygon occurred in 52.3%.
2. A truly incomplete circle unquestionably devoid of artifacts occurred in only two

circles, in both of which the left posterior communicating artery was absent.

3. The most frequent anomaly was a filiform, or string-like caliber of one of the component vessels, in 27.4% of the circles. This was most frequently present in one or both posterior communicating arteries.

4. There was a duplication of vessels in 18.9% of the circles examined. The anterior portion of the circle was the favorite site of such accessory vessels, and the anterior communicating artery was most frequently involved. In 8% of the circles there was a midline persistent corpus callosal branch.

5. The embryonic origin of the posterior cerebral artery from the internal carotid artery persisted in 14.6% of the circles.

6. The anomalies were multiple in 13.4% of the series.

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Boeck's Sarcoid Simulating a Brain Tumor

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Introduction

Invasion of the nervous system by Boeck's sarcoid occurs not infrequently. Most commonly the peripheral and cranial nerves are affected.² The central nervous system is less frequently involved. When it is involved, it may be invaded by a diffuse granulomatous leptomenigitis, most commonly at the base of the brain,^{11,14} or the disease may occur as a diffuse perivascular infiltration within the brain substance,¹¹ or, rarely, the picture may be that of an acute or a chronic meningoencephalitis.⁹ Not uncommonly, sarcoid lesions may invade the pituitary gland, giving rise to diabetes insipidus.^{10,14} The following case is of interest in that it presented a clinical picture of a brain tumor, and at craniotomy a granulomatous mass, resembling a meningioma, was found.

Report of a Case

The patient, a 39-year-old Negro male office worker, was born in New York City of British West Indian parentage. He had never lived outside the United States. The patient was well until 1952, when he began to have spells during which he suffered sudden loss of vision. The episodes lasted a few seconds and occurred two or three times a week. In 1953 he became aware of blurred vision. Visual acuity was 20/50 bilaterally, and there was concentric narrowing of the visual fields.

Laboratory data included a white blood cell count of 8,200 per cubic millimeter and a sedimentation rate of 34 mm. in one hour. Radiographic studies of the chest and skull were negative.

In August, 1955, he was reexamined. Neurologic findings were within normal limits except for bilateral primary optic atrophy and a sluggish reaction of the pupils to light. Electroencephalography was negative. At this time vision was 20/70 O. D. and 20/50 O. S. His vision continued to get worse, so that by June, 1956, it was 10/500

O. D. and 20/300 O. S. There was no polydipsia, polyuria, polyphagia, or loss of libido.

In July, 1956, the veteran was admitted to the Jewish Hospital (Brooklyn). Skull films showed destruction of the posterior clinoid processes, the floor of the sella, and probably part of the anterior clinoid processes. The optic foramina were widened. The right carotid angiogram showed the anterior cerebral artery to be narrowed near its origin and to be displaced posteriorly and the first portion to be elevated. On July 1, 1956, Dr. Meyer Rosenberg performed a right frontal craniotomy. He found a large tumor, which appeared to be a meningioma. The mass was noted in the right subfrontal area, extending to the longitudinal sinus and falx, and then spreading to involve *en plaque* the dura of the convexity of the left frontal lobe. The tumor was resected partially. The bone flap was not replaced. The pathologic report was chronic granuloma, probably tuberculous, although no bacilli were seen in stains for acid-fast organisms, and there was no caseation.

After the operation, the patient's vision improved somewhat, so that he was able to recognize faces, as he had not been able to do previously. In December, 1956, however, his vision became worse, acuity being 20/400 bilaterally. The discs were pale.

In March, 1957, the patient was admitted to the Veterans Administration Hospital of Brooklyn. Examination revealed a surgical defect in the right frontal area with a bulging mass, which on palpation appeared cystic. He was alert and well oriented, without memory defect, although he was frequently uncooperative. Tests of motor power, deep tendon reflexes, cerebellar function, appreciation of painful stimuli, and all other sensory modalities failed to reveal abnormal findings. There were no pathologic reflexes. The left pupil was larger than the right; the right pupil did not react to light, and the left reacted only sluggishly. There was marked pallor of the optic discs. On psychological testing the patient showed a Wechsler Verbal I. Q. of 93. He also showed concrete thinking, perplexity, and vocabulary loss. There were marked suspiciousness, ideas of reference, and uncooperativeness. Initial work-up revealed the following: white cell count, 5,100, with 5% eosinophils; sedimentation rate (Wintrobe), 23 and 32 mm., corrected; calcium, 10.6 to 11.7 mg. %; alkaline phosphatase, 4.4 King-

Accepted for publication April 7, 1958.

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Armstrong units; total serum protein, 8.0 to 8.4 gm. %; albumin, 4.4 to 4.9 gm. %; globulin, 3.1 to 3.9 gm. %; cephalin flocculation, 4+ and 2+ in 48 hours; cholesterol, 375 mg. %, and esters, 322 mg. %; blood sugar, 110 to 117 mg. %. Lumbar puncture on April 15, 1957, yielded fluid under a pressure of 300 mm. of water, with 5 white cells per cubic millimeter and 80% lymphocytes; protein, 654 mg. %, and colloidal gold curve 444443221. Cultures were negative for bacteria, fungi, and tubercle bacilli. A bone-marrow examination showed an increased eosinophil count. Liver biopsy revealed fatty infiltration. The chest x-ray was negative. An electroencephalogram showed diffuse cerebral dysfunction with focal accentuation in the right frontal and central regions. Tuberculin, histopalsmin, blastomycin, and coccidioidin skin tests were negative. The Kveim test biopsy was reported as showing epithelioid granuloma without caseation.

In May, 1957, the patient was started on steroid therapy. Initially, hydrocortisone, 100 mg. a day, was administered; later medication was changed to prednisone, 40 mg. a day. It was noted that within three weeks the patient became more sociable on the ward. Previously, he had spent most of the time in bed. After therapy he became more active. His previously noted suspiciousness and ideas of reference became less apparent. Vision, however, did not appear to improve noticeably until about six weeks after the onset of therapy.

Laboratory examinations after two months of therapy revealed the following: lumbar puncture, initial pressure, 150 mm. of water; no cells; glutamic-oxalacetic transaminase 2.3 units. Guinea-pig inoculation for tuberculosis was negative. Differential blood count showed 1% eosinophils. Sedimentation rate was 3.1 mm. in one hour; total protein 7.9 gm. %; albumin, 3.9 gm. %; globulin 4.0 gm. %. Serum electrophoresis: albumin 38.7%; α_1 -globulin 4.3 %; α_2 -globulin 15.0%; β -globulin 16.5%, and γ -globulin 25.9%; alkaline phosphatase 7.2 King-Armstrong units; acid phosphatase 12 King-Armstrong units; calcium 10.2 mg. %; cephalin flocculation 3+; C-reactive protein 3 mm.

After two months the dosage of prednisone was reduced to a maintenance level of 15 mg. per day. The patient continued to show psychological improvement, but, because of the optic atrophy, vision did not improve beyond 4/200 bilaterally. After four months of therapy, examination of the cerebrospinal fluid revealed a pressure of 120 mm. of water, no cells, and protein reduced to 111 mg. %. The colloidal gold curve became normal. Serum protein, calcium, cephalin flocculation, cholesterol, and sedimentation rate remained unchanged. The patient was discharged from the hospital on November, 1957.

Comment

This case of Boeck's sarcoid simulating a brain tumor, like most of the others in the literature, was not diagnosed preoperatively. There are several other points in this case which are worthy of note. This patient has no evidence of Boeck's sarcoid elsewhere. Most of the other reported cases of central nervous system sarcoid have shown sarcoidosis in one or more of the other organs. This patient showed many of the usual laboratory features associated with Boeck's sarcoid. These included elevated serum calcium with normal phosphorus, eosinophilia on occasion, a persistently elevated sedimentation rate, and a negative tuberculin skin test. Spinal fluid findings were markedly increased protein, normal sugar and chlorides, few cells, and a first-zone colloidal gold curve. The commonest spinal fluid finding is an elevated protein, which may be as high as 720 mg. %.⁴ In 22 cases of elevated cerebrospinal fluid protein in central nervous system sarcoid the median value was 275 mg. %. The protein was normal in approximately 20% of the cases. The colloidal gold curve has been reported in 11 cases; 4 had first-zone curves; 3 were midzone in type, and 4 were normal. In central nervous system sarcoid a low cerebrospinal fluid sugar is often found.¹⁴ Of 12 previous cases^{9,11,12,14} a low cerebrospinal fluid sugar was present in 5. Pennell¹⁴ also noted low cerebrospinal fluid chloride in three of six cases. In many of the cases of systemic Boeck's sarcoid, elevated serum globulin, particularly the γ -fraction, is a characteristic feature. In this case, as in most of the other cases of central nervous system sarcoid and in all of the few cases of circumscribed tumor-like sarcoid, there was no elevation of the globulin fraction. Of the reported cases of Boeck's sarcoid of the central nervous system, five have presented a circumscribed granulomatous mass (Table 1). Five additional cases had clinical evidence of tumor but did not have actual circumscribed masses (Table 2). Table 1 analyzes the five preceding cases of

BOECK'S SARCOID SIMULATING TUMOR

TABLE 1.—Previous Cases of Tumor-like Boeck's Sarcoid

Author Case Year	Age & Sex	Symptoms, Duration, Laboratory Data	Operation and Pathology	Sarcoid Elsewhere	Follow-Up
Everts ⁵ 1947	27 C M	Convulsions, 10 yr.; headache, diplopia, 6 mo.; hemiparesis, rt. facial; rt. homonymous hemianopsia; eosinophilia	Craniotomy; large occipital lobe tumor, completely removed	Hilar nodes; mass in post. pharynx; biopsy, sarcoid	6 mo.; well except for residual hemianopsia
Askanazy ¹ Case 5 1952	41 F	Primary optic atrophy, bitemporal field defect; no other Hx available	Craniotomy; "meningioma"; optic nerve swollen; tumor extended to floor of 3d ventricle, felt to be inoperable; biopsy only	Unknown	Unknown
H66k ⁷ Case 1 1954	25 M	Rt. homonymous hemianopsia; mental sluggishness, 1 mo. duration; CSF protein 76 mg. %; cells 189/3.2 mm.	Clinical: 2 poorly vascularized lesions in anterior part of l. Sylvian region seen on PEG and angiogram	Lymph node; biopsy, "sarcoid"; splenomegaly	2 mo. later, PEG showed decreased size of tumors; 1 yr. later, no symptoms
H66k ⁷ Case 2	50 M	Tiredness, apathy; hemiplegia increased; lethargy, 1 yr. Supranuclear facial paralysis and hemiplegia; fundi neg. CSF protein 140-300 mg. %; cells 16-90; total serum protein 6.3 gm. %; Hlb. 4.3 gm. %; glob. 2.0 gm. %	Craniotomy; 2X3 cm. mass inferior horn of lateral ventricle, arising from choroidal plexus, grossly choroidal papilloma Tumor removed	Lymph nodes; hepatomegaly	Two yr. later, well except for postop. sequelae
Ross ¹⁴ 1955	M First seen, age 24; brain tumor, age 30	Initially seen with visual defect and enlarged parotids due to sarcoid; age 29, began to have memory loss, papilledema, pyramidal signs, quadrantic field defect X-ray: erosion of sella	Craniotomy: temporal lobe tumor, grossly astrocytoma; temporal lobectomy	Iris, ciliary body; hilar nodes, parotid; liver biopsy neg. Autopsy: few nodules in liver	Well for 12 yr.; slow onset; rt. paralysis; seizures; died 13 yr. postop. Autopsy: miliary bodies at site of lobectomy & rt. occipital lobe

tumor-like Boeck's sarcoid. The age range of 25 to 50 corresponds in general to that found in sarcoidosis.¹⁵ Four of the five patients had craniotomies. The fifth showed two tumor masses on angiography and pneumoencephalography. The tumors occurred in almost all parts of the brain, with one each in the occipital lobe, temporal lobe, and lateral ventricle, one in the frontal lobe, and one in the optic nerves and region of the third ventricle. The duration of symptoms was from 1 month to 10 years. Except for one case, about which little was known, the remaining four had clinical evidence of sarcoid elsewhere. As was mentioned above, only two previous cases have been reported which have had any form of central nervous

system sarcoid without having lesions elsewhere.^{1,17}

Table 2 summarizes the five preceding cases with clinical evidence of tumor but no actual circumscribed granuloma. Three had an adhesive arachnoiditis in the posterior fossa, which blocked the foramina of Luschka and Magendi, giving rise to symptoms suggestive of posterior fossa or cerebellar tumor. One case was diagnosed clinically, and the patient was not operated upon but received a course of x-ray therapy. Another case had diffuse perivascular granulomata with cerebral edema, and the fifth had small cortical granulomata, giving rise first to seizures and then to paralysis. Three of these patients died within five years of central nervous system sarcoid.

TABLE 2.—Cases of Pseudotumor Due to Boeck's Sarcoid

Author & Case No.	Age Race Sex	Symptoms and Duration	Operation and Pathology	Follow-Up
Erickson et al. ³ 1942	31 W M	Dizziness, tinnitus, hearing and visual loss, 3 mo. projectile vomiting	Craniotomy: adhesive arachnoiditis over base with obstruction of foramina of Luschka & Magendi and herniation of tonsils of cerebellum	Died 1 yr. postop. of recurrent symptoms
Colover ² Case 3 1948	23 W F	Headache, vomiting, fever 2 yr. later, papilledema, nystagmus	Posterior fossa exploration: adhesive arachnoiditis with obstruction of 4th ventricle foramina; opening made to allow circulation	Slow recovery
Pennell ¹⁴ 1951	48 W M	Headache, unequal pupils; 2 yr. later, stiffness of neck, vertigo, tinnitus, hearing loss, 6th nerve palsy Complete manometric block	Clinical diagnosis: posterior fossa sarcoid; received x-rays, 6000 r	Remissions and exacerbations of neurologic symptoms Died 5 yr. after first symptoms
Aszkanazy ¹ Case 4 1952	23 M	Left sided Jacksonian seizures 9 yr.; later, paralysis Initial craniotomy negative	Craniotomy: small cortical scars, rt. pre- & postcentral gyri; small miliary lesions in meninges invading cortex	Decreased number of seizures p. o.; spastic paresis 5 yr. later unchanged
Meyer ¹¹ 1953	51 W M	Headache, anorexia, confusion; 10 days later, bilateral Babinski sign, papilledema	Craniotomy: cerebral edema; miliary lesions along course of pial vessels; no involvement of white matter	Died in postop. period

In selected patients, steroids seem to exert a favorable response on Boeck's sarcoid, particularly in cases with renal, myocardial, and ocular involvement.⁸ In three cases of sarcoid, involving the pituitary, manifested by symptoms of hypopituitarism, steroids did not exert a favorable effect.^{8,10} Pennell¹⁴ reported a case of diffuse central nervous system sarcoid in which two courses of corticotropin and cortisone were without effect. Olsen¹³ reported one case with facial nerve palsy and abnormal spinal fluid which responded to cortisone within two weeks. Fitzpatrick⁶ treated one case showing diffuse brain involvement with prednisone, 80 mg. a day initially, then 20 mg. a day. The patient showed marked improvement within four days and was found to be well, on continuous therapy, after a nine-month follow-up. Moldover¹⁸ has treated a case with spinal cord involvement with cortisone. This patient showed improvement on therapy and regression when taken off. The patient is well after two and one-half years of therapy. Our patient also appeared to show striking improvement after prednisone therapy.

Because of the present availability of medical treatment for Boeck's sarcoid, it is important to recognize that in some cases the clinical picture of a neurologic disorder,

even a brain tumor, may be due to this disease. In a patient with manifestation of sarcoid in other tissues, i. e., in lymph nodes, lungs, liver, spleen, etc., symptoms of an intracranial space-occupying lesion should suggest the possibility of invasion of the neural tissue by sarcoid.

Summary

A case of Boeck's sarcoid presenting as a brain tumor is reported. The previous cases in the literature are reviewed.

It is recommended that patients with Boeck's sarcoid in other tissues and with evidence of an intracranial space-occupying lesion receive a trial of steroids before resorting to surgery.

1002 Avenue J (30) (Dr. Margulies).

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Hemorrhagic Encephalopathy Induced by Hypernatremia

I. Clinical, Laboratory, and Pathological Observations

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Hyperosmolality is characterized by an increase in the solute concentration of body fluids brought about by loss of water, inadequate water intake, or administration of large amounts of hypertonic solutions. When the osmolar concentration of the extracellular fluid is increased, transfer of water from cells to extracellular fluid exceeds that in the opposite direction. Net water movement is thus out of the cells, with resultant dilution of extracellular fluid and concentration of the fluid within cells themselves. If the solute which increases the extracellular fluid osmolality is one which is in the main excluded from intracellular fluid, such as sodium and chloride ions, this disturbance in water distribution cannot be mitigated by movement of solute into cells. Hence, the ultimate effect of hypernatremia is dehydration of cells. This physicochemical disorder is most frequently encountered in infants and children with severe diarrhea and vomiting, but it also occurs in adults.

Schmidt,¹ in 1850, reported high chloride concentration in the serum of some infants with diarrhea, and the first description of this state is generally attributed to him. In the United States, clinical interest in hyperosmolality was aroused by Rapoport² in the late 1940's. Several authors³⁻⁸ have

emphasized central nervous system disturbances in patients with severe dehydration and hypernatremia. The question is raised, therefore, whether central nervous system lesions cause hyperosmolality, or whether hypernatremia produces central nervous system lesions. In these patients, the neurological symptoms were particularly evident when the biochemical disorder developed rapidly. Subarachnoid and subdural effusions certainly occurred in several infants,^{5,7} suggesting that hemorrhagic lesions may be of primary importance in the encephalopathy associated with hypernatremia. Our purpose is to describe the clinical, laboratory, and pathological findings in three infants with neurological disorders due to severe dehydration and hypernatremia. This provides certain basic information for experimental studies on hyperosmolality in cats, to be described in a subsequent paper.

Report of Cases

CASE 1.—Patient admitted Nov. 7, 1957; died Nov. 11, 1957.

An 8-month-old Negro boy was seen in the outpatient department with a history of vomiting and diarrhea of three days' duration. He appeared only mildly dehydrated, with signs of an upper respiratory infection and a temperature of 38.9 C (101.1 F). He was given penicillin and streptomycin intramuscularly. Administration of clear fluids by mouth was advised. During the following day, he vomited twice and had two loose stools, but urinary output seemed adequate. He did, however, look sick and dehydrated, and his fever was unchanged. There were no other abnormal physical signs of note. Spinal fluid was normal, and a blood culture subsequently proved sterile. He was given a trisulfapyrimidines suspension (triple sulfonamides), more penicillin and streptomycin, and a hypodermoclysis of 250 cc. of one-fourth-

Accepted for publication Nov. 6, 1958.

Kenny Foundation Scholar (Dr. Luttrell).

This investigation was supported by research grants B1409 and E1230 from the National Institutes of Health, U. S. Public Health Service.

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strength lactated Ringer's injection U. S. P. On the following day, fever, diarrhea, and vomiting persisted. He had become irritable and had not voided for six hours. He was therefore admitted to the hospital.

On admission, he was in no distress, but was mildly dehydrated. The vital signs were as follows: temperature 37.5 (99.5 F); pulse 126 and respirations 32, per minute, blood pressure 115/90; weight 8,300 gm. Except for mild dehydration, a depressed fontanel, and a liver edge palpable 2 cm. below the right costal margin, there were no abnormal physical findings. Laboratory studies showed hemoglobin 9.0 gm/ml.; white blood cell count 10,500; polymorphonuclear leukocytes 55%, and lymphocytes 43%. The urine was cloudy; specific gravity, 1.035; pH, 6.0; protein, 3+-4+; sugar, trace. Microscopic study (centrifuged specimen) showed 5-6 rbc per high-power field, and many hyaline and granular casts. Serum analyses showed NPN 70 mg/100 ml., sodium 159 mEq/L., CO_2 13.2 mEq/L., chloride 132 mEq/L., and potassium 5.5 mEq/L.

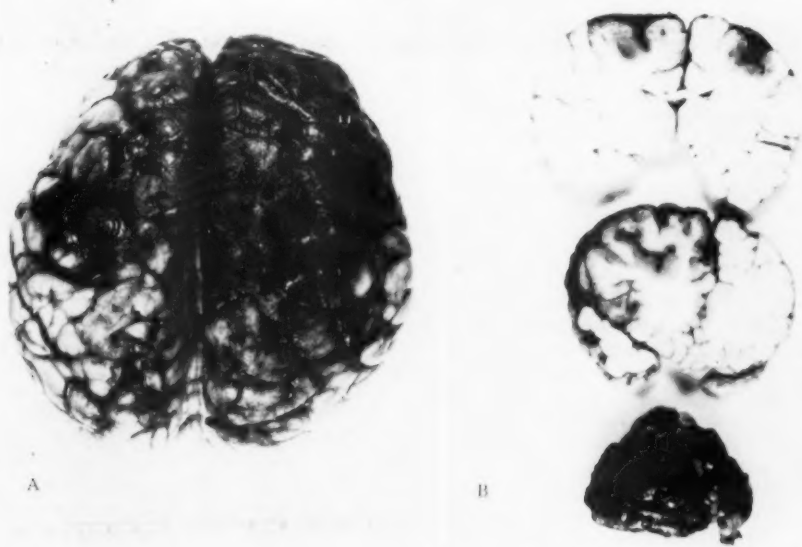
The infant took a milk formula well during the first 48 hours of hospitalization. He voided four times within the first 24 hours and five times on the second day. The temperature, however, remained around 38-39 C (100.4-102.2 F). Throat,

blood, and urine cultures were negative. A nasopharyngeal culture showed a few colonies of hemolytic *Staphylococcus aureus*. Chest x-rays and an electrocardiogram were normal. The urine continued to show 3+-4+ protein, numerous white blood cells and red blood cells, but fewer casts. On the third hospital day he had a generalized convulsion. Despite intramuscular phenobarbital, he had another convulsion four hours later. Serum analyses at this time were as follows: NPN 80 mg/100 ml.; sodium 174 mEq/L.; chloride 127 mEq/L.; potassium 4.6 mEq/L.; CO_2 11.5 mEq/L.; glucose 240 mg/100 ml.; calcium 11.3 mg/100 ml., and phosphorus 5.7 mg/100 ml. Several hours later he began to breathe more rapidly, with a rate varying from 30 to 50 per minute, and had a pulse rate of 120-160 per minute. Rales were heard in the lungs. He was given one-fourth of the estimated dose of a digitalis glycosides preparation (Digalen) required for full effect. He voided only once that day, and the blood pressure stabilized at 120/60. A few hours later, however, he suddenly became hypotensive and died.

Autopsy.—The body was that of a well-nourished and developed boy, weighing 8,500 gm. There were numerous venipuncture sites in both femoral triangles. The organs were pale. No

Fig. 1 (Case 1).—A, dorsal view of the brain, showing bilateral subarachnoid hemorrhage of venous drainage areas. The hemorrhage is more marked on the right and is associated with swelling of the right cerebral hemisphere.

B, coronal sections of the brain, showing bilateral hemorrhagic softening, greater on one side than the other. The lowest section is the frontal poles.



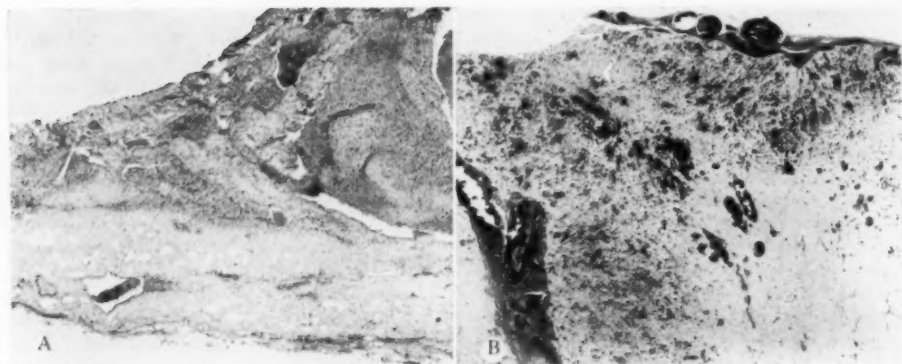


Fig. 2 (Case 1).—*A*, section showing organizing thrombi of the sagittal sinus and bridging veins of the dura mater. H and E stain; reduced to 61% of mag. $\times 35$.
B, section through the parietal cortex showing hemorrhagic necrosis and thromboses of pial vessels. H and E stain; reduced to 61% of mag. $\times 10$.

lesions were seen in the heart. The pleural surfaces of the lungs were smooth. There were several clots in the pulmonary arteries to the left lung, which, in the lower lobe, appeared to distend the vessels and may have represented emboli. The liver was pale and its architecture obscure. The gallbladder, bile ducts, duodenum, pancreas, ureters, bladder, esophagus, stomach, rectum, spleen, and adrenals were normal.

There was an adherent clot in the superior sagittal sinus. Dural veins were markedly distended. There was extensive subarachnoid bleeding over the cerebral hemispheres. This hemorrhage was more prominent on the right, with softening of the underlying cortex (Fig. 1*A* and *B*). The gyri were flattened and the convolutions narrowed. There was bilateral uncus herniation, and the peduncles appeared flattened. The hypophysis was normal, as were the arteries of the circle of Willis. The cranial nerves were intact. On section, bilateral hemorrhagic necrosis, involving the gray and white matter to a depth of 1.5 cm., was most prominent in the region of the motor strip on the right (Fig. 1*B*). The ventricular system was not dilated, and the choroid plexuses were intact. The cerebellum and brain stem were unremarkable.

Microscopically, the heart was normal. Acute and chronic submucosal inflammatory foci were present in the trachea. The lungs were congested with multiple pulmonary thrombi. Numerous hemosiderin-pigmented macrophages were found in patchy areas of infarction. The spleen showed sinusoidal prominence with lymphoid hyperplasia, and moderate numbers of acute splenic tumor cells. Severe hepatic cytoplasmic vacuolation was present, with central venous congestion. The gastric mucosa was denuded. The kidneys were completely normal, as were also pancreas, gallbladder, testes, prostate, thymus, skin, muscle, hypophysis, aorta, and bone

marrow. There was an organizing thrombus in the sagittal sinus with early fibroblastic ingrowth. (Fig. 2*A*). Massive areas of hemorrhagic necrosis were present in the brain along with widespread subarachnoid hemorrhage (Fig. 2*B*).

An 8-month-old boy was admitted to the hospital with a four-day history of vomiting and diarrhea. Serum electrolyte determinations disclosed hyponatremia. Despite fluid replacement therapy, oliguria developed. Serum sodium concentration continued to rise. Convulsions and death soon followed. At necropsy, thrombosis of the superior sagittal sinus was found, with bilateral hemorrhagic softening of the involved venous drainage areas.

CASE 2.—Patient admitted Oct. 8, 1954; died Oct. 13, 1954.

This was the first hospital admission of the patient, a 2-month-old Negro girl, with diarrhea and vomiting of four days' duration. The family, past, and developmental histories were all non-contributory. The infant was apparently entirely well until four days before admission, when she was exposed to two siblings with acute respiratory infections. Late in the evening that day, she developed diarrhea and vomiting. Three days before admission, she was seen at another hospital and was treated with Coca-Cola syrup. In the 48-hour interval before admission, she had five to eight loose, watery stools per day with an indefinite number at night. For 12 to 18 hours before coming to the hospital she was tremulous and irritable, and refused feedings. In the accident room, she was started on treatment with an oral electrolyte solution. Overnight, however, she had 10 further

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large, loose watery stools and was, therefore, admitted to the hospital.

Examination on admission revealed an extremely dehydrated, moribund infant. The vital signs were as follows: temperature 99.8 F, pulse 160 and respirations 55, per minute; weight 3,090 gm. The eyeballs were soft and sunken, and the anterior fontanel was depressed. Respirations were shallow, though the lungs were clear. The heart was normal. The liver edge was just palpable. The skin and mucous membranes were dry. The left eardrum was inflamed. The neck was supple. Superficial and deep tendon reflexes were depressed throughout. No pathological reflexes were elicited. There were no obvious cranial nerve signs, and the fundi were normal.

Initial laboratory studies showed a white cell count of 12,000 per cubic millimeter, with a normal differential count, and hemoglobin 10 gm/100 ml. Urinalysis showed specific gravity 1.018, pH 5.0, 2+ proteinuria, no sugar, a few epithelial cells, and 2-3 red blood cells per cubic millimeter. Serum analyses were as follows: sodium 179 mEq/L.; chloride 143 mEq/L.; CO_2 8.2 mEq/L.; potassium 5.2 mEq/L.; BUN 62.8 mg/100 ml., and calcium 8.2 mg/100 ml. The electrocardiogram was normal. The spinal fluid was grossly bloody, though the pressure was not recorded. Centrifuged immediately, it gave a deeply xanthochromic supernatant fluid. Blood, nose, throat, and urine cultures revealed no abnormalities.

The infant was immediately given intravenous and subcutaneous fluids, antibiotics, and oxygen. In the first 12 hours she seemed to improve clinically, although she failed to void. Twenty-two hours after admission, diuresis followed intravenous administration of additional 10% dextrose and water. Thereafter, however, she became tremulous, and an electrocardiogram showed changes indicative of hypocalcemia and hypokalemia. Temporary improvement followed transfusion and replacement of fluids, with additional calcium. An attempt was then made to start the patient on oral feedings, but little was taken. She became progressively more lethargic, though tremulous, and had two convulsions. She died on the morning of the fourth hospital day, 15 minutes after the second convulsion. Serum analyses on the morning of death showed sodium 165 mEq/L., chloride 140 mEq/L., CO_2 10.1 mEq/L., potassium 10.8 mEq/L., calcium 11.8 mg/100 ml., phosphorus 13.2 mg/100 ml., and BUN 41.6 mg/100 ml.

Autopsy.—The body was that of a poorly nourished female infant, weighing 3,435 gm. The contents of the abdominal cavity appeared grossly normal. The heart was normal. The lungs weighed 60 gm. Trachea and bronchi were normal. On cut section, the basal lobes were poorly aerated and meaty in consistency. Foamy fluid was expressed

from the small bronchi. The liver, gallbladder, spleen, gastrointestinal tract, and pancreas were normal. The combined weight of the kidneys was 33 gm. They were pale but normal in size, shape, and anatomical position. On cut section, the cortices and pelves were normal. The adrenals weighed 5 gm. They were normal in appearance.

The leptomeninges were markedly congested with blood in the vicinity of many vessels. Small red blood clots were found in the subarachnoid spaces of the posterior fossa and in the third and lateral ventricles. The hypophysis was reddish in color.

Microscopically, there was focal heme pigment in the convoluted tubules of the kidneys. The collecting tubules were filled with acidophilic debris and urate spheroids, with dilatation of the proximal tubular apparatus (Fig. 3A). There were multiple microscopic pulmonary emboli with widespread edema of the lungs. The brain showed dilatation and thrombi of subependymal vessels of the lateral and third ventricles (Fig. 3B), in addition to intracerebral (Fig. 3C), subarachnoid (Fig. 3D), and intraventricular bleeding. There was a massive hemorrhage of the pars posterior of the hypophysis (Fig. 3E and F). The meningeal vessels were dilated and congested.

A 2-month-old infant with diarrhea and vomiting of four days' duration was admitted to hospital in a moribund state. Oliguria, tremulousness, convulsions, and death occurred, despite fluid replacement, antibiotics, and symptomatic treatment. Pathological examination disclosed intracranial bleeding and massive hemorrhage of the pars posterior of the hypophysis. There were thrombi in subependymal vessels and intraventricular hemorrhage. The complicating posterior pituitary lobe hemorrhage may have contributed further to terminal irreversible water and electrolyte disturbances. The renal changes may well have resulted from inspissation of urine, and precipitation of protein urates and blood pigment in the collecting tubules.

CASE 3.—Patient admitted April 21, 1957; died April 21, 1957.

This one-month-old, premature Negro girl was admitted to the hospital with a seven-day history of regurgitation of feedings and diarrhea. In the week before admission, she became increasingly lethargic and had to be awakened for feedings. Her respirations became more shallow and rapid. One day before admission, she had an increasing, but indefinite, number of green, watery stools. In the accident room, she passed four loose stools in

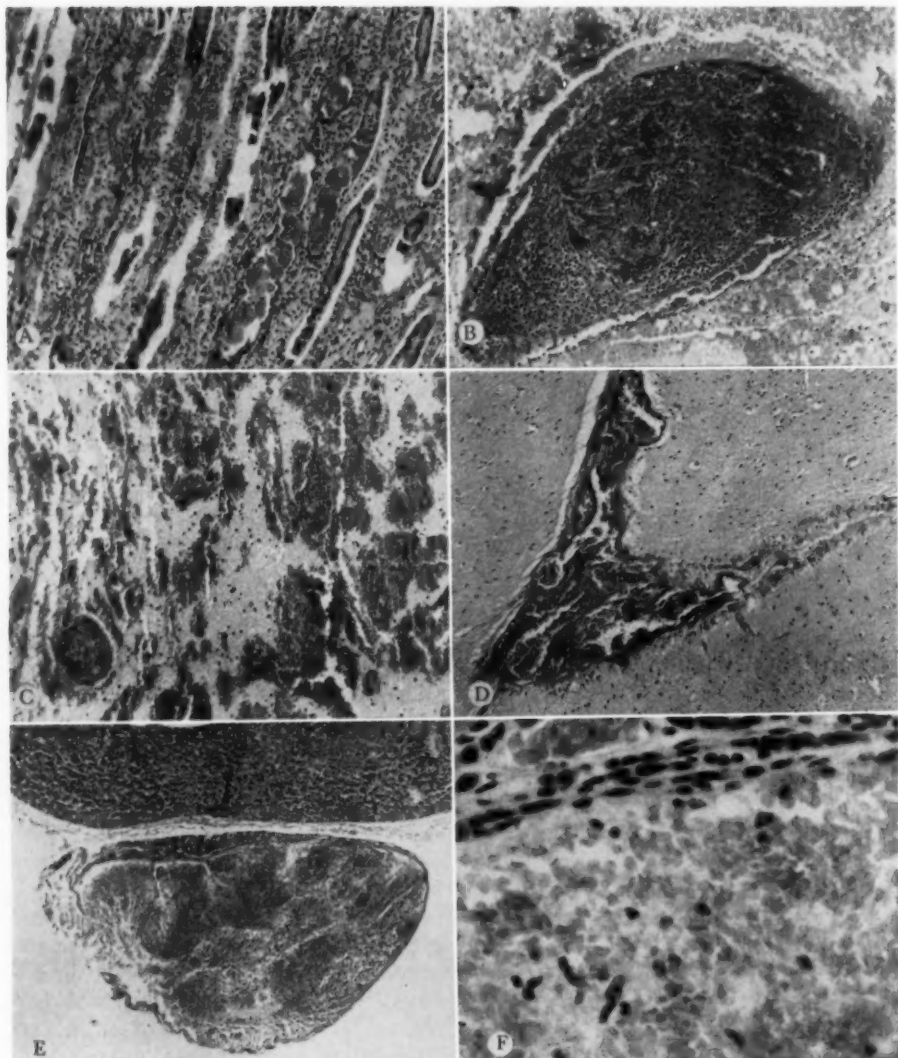


Fig. 3 (Case 2).—*A*, section from the renal medulla, showing collecting tubules filled with acidophilic debris and urate spheroids. H and E stain; reduced to 61% of mag. $\times 125$.

B, section through the hypothalamus, showing an organized thrombus of a small vein. H and E stain; reduced to 61% of mag. $\times 125$.

C, section through the hypothalamus, showing hemorrhagic necrosis and edema and an organized thrombus in a small vein. H and E stain; reduced to 61% of mag. $\times 125$.

D, section through the cerebral cortex, showing edema, and intense vascular congestion and subarachnoid hemorrhage in the depth of a sulcus. H and E stain; reduced to 61% of mag. $\times 100$.

E, section through the hypophysis, showing massive hemorrhage into the pars posterior. H and E stain; reduced to 61% of mag. $\times 50$.

F, high-power magnification of the pars posterior of the hypophysis, showing hemorrhage and loss of nerve cells. H and E stain; reduced to 61% of mag. $\times 750$.

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30 minutes. Throughout the illness there had been progressive weight loss.

On admission, the infant was acutely ill and tachypneic. The vital signs were as follows: temperature 97.4 F; pulse 150 and respirations 72, per minute; weight 2,079 gm. She seemed alert. The cry, however, was piercing and shrill. The anterior fontanel was depressed and the eyes sunken and soft. Skin turgor and elasticity were poor and the mucous membranes dry. The chest was clear to auscultation and percussion. Heart sounds were difficult to hear. The abdomen was somewhat distended, with the liver felt one fingerbreadth below the costal margin. The spleen was not palpable. The neurological examination was unremarkable.

While in the treatment room, the infant stopped breathing during an attempt to start fluid therapy. Repeated suction and intracardiac epinephrine 0.2 cc. of 1:1,000 solution, were ineffectual. She died 15 minutes after hospital admission. Immediate postmortem specimens of blood and spinal fluid were obtained for chemical analysis and culture. The white blood cell count was 30,000, with a normal differential count. Hemoglobin was 18 gm/100 ml. The spinal fluid was grossly bloody and xanthochromic. Postmortem

serum analyses showed sodium 180 mEq/L., potassium 6.3 mEq/L., chloride 151 mEq/L., and CO_2 7.7 mEq/L. Blood and spinal fluid cultures were negative. X-ray examination of the whole body and chest were normal.

Autopsy.—The body was that of a premature, dehydrated female infant, weighing 2,079 gm. The skin was wrinkled. The contents of the abdominal cavity were normal. The lungs were of normal appearance, and on cut section appeared crepitant and pinkish red in color. The neck organs were normal. Moderate congestion of superficial meningeal vessels was noted. Intracranial hemorrhages were seen near the midline of the hemispheres and over the inner aspects of the inferior surfaces of the frontal lobes. Scattered small subarachnoid hemorrhages were present, especially in the depths of the sulci. The hypophysis was reddish in color. Spinal fluid in the subarachnoid space about the spinal cord was also bloody.

Microscopic examination revealed moderate edema of the lungs, with desquamation of epithelial cells. There were moderate congestion of the splenic sinusoids and mild hyperemia of adrenal medullary capillaries. Extensive hepatic cytoplasmic vacuolation was present. The remaining thoracic and abdominal organs were normal. There

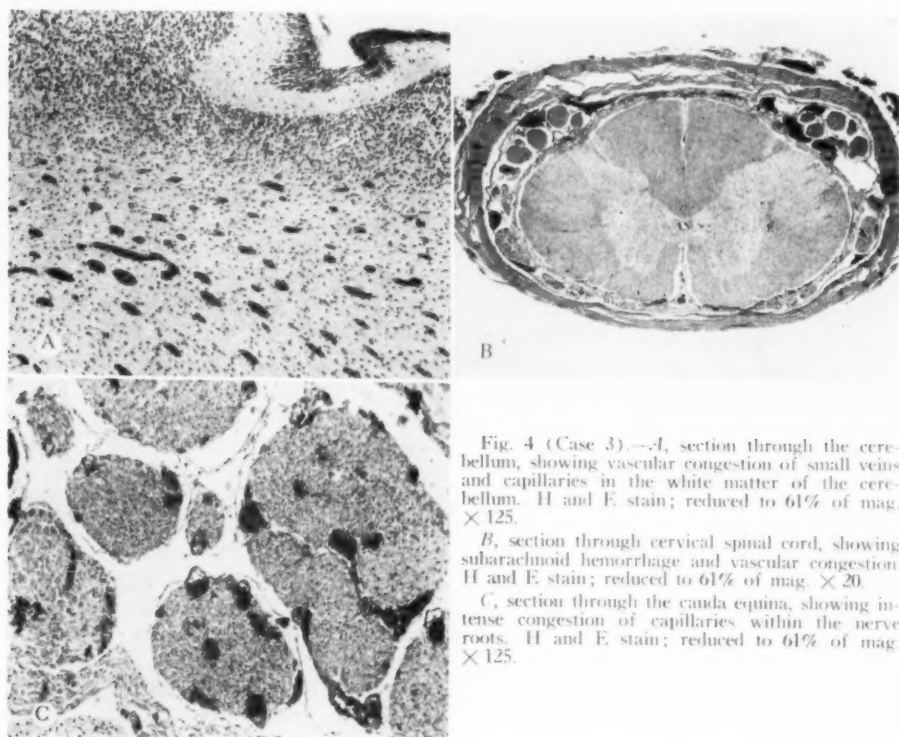


Fig. 4 (Case 3).—A, section through the cerebellum, showing vascular congestion of small veins and capillaries in the white matter of the cerebellum. H and E stain; reduced to 61% of mag. $\times 125$.

B, section through cervical spinal cord, showing subarachnoid hemorrhage and vascular congestion. H and E stain; reduced to 61% of mag. $\times 20$.

C, section through the cauda equina, showing intense congestion of capillaries within the nerve roots. H and E stain; reduced to 61% of mag. $\times 125$.

was extensive vascular congestion of capillaries and small veins of the cerebral hemispheres and cerebellum (Fig. 4A), midbrain, pons, and medulla. Occasional small, petechial hemorrhages were found in the cerebral cortex and centrum semiovale, the white matter of the cerebellum, and the gray and white matter of the spinal cord. There was moderate hyperemia of the anterior lobe of the hypophysis. Representative sections from different levels of the spinal cord all showed subarachnoid hemorrhage (Fig. 4B) and marked congestion of capillaries and small veins. This was particularly striking in the capillaries of the spinal nerve roots (Fig. 4C).

A neglected one-month-old female infant, with poor fluid intake, diarrhea, and vomiting of one week's duration, died 15 minutes after admission to the hospital. Immediate postmortem serum analyses confirmed the diagnosis of hypernatremia. Pathological examination of the nervous system showed intradural and subarachnoid hemorrhage. There was intense vascular congestion of small veins and capillaries throughout the nervous system with occasional small, petechial hemorrhages of the brain and spinal cord. The kidneys appeared normal.

Comment

The threat of hypernatremia is greater in children than in adults. One obvious reason for this is the higher incidence of diarrhea and vomiting in children, coupled with greater water requirements per kilogram. Another is the increased chance of accidental salt ingestion with its attendant complications. In young infants, an additional factor of significance in the pathogenesis of this syndrome is the relative inadequacy of maximal renal osmotic concentration.^{9,10}

The problem of hypernatremia, however, is not limited to infants with diarrhea and vomiting. Hyperosmolarity in adults has appeared in several seemingly unrelated clinical settings. Of these, head injuries or intracranial lesions have received considerable emphasis.^{4,11,12} Indeed, it has been suggested by some that hyperosmolarity is secondary to some disturbance of water-regulating mechanisms of neurogenic origin. However, Zierler¹³ analyzed the published

protocols of patients with hyperosmolarity attributed to such causes and showed that, when sufficient clinical and laboratory data were given, the hyperosmolarity could be explained as a consequence of insufficient water intake in the face of excessive water loss. He concluded, therefore, that there was little evidence that the syndrome is in general the result of an intracranial lesion.

Hypernatremia may readily be produced in the hospital by administration of large amounts of sodium chloride, even as isotonic saline, especially to patients with selective renal tubular damage. This process may well be accentuated by the concomitant use of agents for the reduction of increased intracranial pressure, such as urea, which in itself produces a solute diuresis removing appreciable amounts of water in excess of sodium. Not uncommonly, hypernatremia may occur and be unrecognized in comatose and stuporous patients maintained for prolonged periods on concentrated tube feedings. An awareness of these possibilities and daily serum sodium determinations can circumvent this complication in the unconscious patient. In this sense, the comatose, stuporous adult is much like an infant, whose fluid requirements must be maintained by careful balance studies.

Clinically, hypernatremia or hypertonic dehydration has itself been noted to be frequently accompanied by central nervous system symptoms. Finberg and Harrison⁵ studied such a group of dehydrated infants, in whom the management of the physiological disturbance was difficult, despite the adequate replacement of water with solutions that were ordinarily effective. Cerebrospinal fluids characteristically showed increased concentration of protein or subarachnoid hemorrhage. Subdural effusions have been demonstrated in some of the acutely ill infants, whereas others have shown significant neurological residua, ranging from moderate to severe disability.^{6,7}

In the present cases, as in others,^{1,5,7} the predominant neurological manifestations of hypernatremia were alterations of con-

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sciousness, varying from lethargy to coma. Tremulousness, muscle twitching, and frank convulsions were also common. The pathological bases for these clinical derangements have not been completely clear or uniform. In the cases reported here, however, hemorrhagic encephalopathy was the prominent pathological lesion. Gross subarachnoid hemorrhage, as well as intradural, intracerebral, and intraventricular bleeding, was also observed. In one case, there was a sagittal sinus thrombosis with hemorrhagic necrosis of the venous drainage areas from both cerebral hemispheres. Another showed subependymal thromboses of small veins and a massive hemorrhage into the posterior lobe of the hypophysis.

It seems clear, therefore, that hypernatremia may be associated with extensive intracerebral, subdural, and subarachnoid bleeding. The present data afford, however, no direct information on mechanisms underlying this vascular damage. It is tempting to consider a purely mechanical explanation. Thus, the stresses created by shrinkage, from cellular water loss, of brain tissue within the rigid cranium might be reflected by stretching, and even tearing, of unsupported vessels. The relatively soft consistency of the immature brain, and its higher normal water content, could theoretically provide more favorable conditions for disproportionate shrinkage than exist in the adult, and thus explain the higher incidence in infancy of such vascular damage. Perhaps, too, the liability of small blood vessels to mechanical injury by such factors as these is heightened in the presence of hypernatremia. In this connection, it may be relevant that Haddy, Emmanuel, and Scott¹⁴ have recently demonstrated vasodilatation and decreased responses of small vessels to pharmacological agents when sodium concentration is elevated locally.

This is not by any means to suggest that the devastating effects of hypernatremia in infancy are due solely to vascular damage. Indeed, there is good evidence that other factors are involved as well. For example, Luttrell and Finberg¹⁵ have produced com-

parable intracranial hemorrhagic lesions in kittens with equiosmolar intraperitoneal infusions both of sodium salts and of urea. Yet the urea-treated animals survived, while those receiving sodium were usually moribund or dead within 24 hours. Apparently, then, there is some deleterious factor associated with hypernatremia beyond the hyperosmolarity and resultant vascular damage. Finberg, Luttrell, and Redd⁸ have shown that brain adapts in a different way to excessive sodium than muscle. Both tissues show transfer of water from cells. In muscle, however, there is considerable entry of sodium into cells, whereas in brain there is little or none. It seems probable that alterations of this nature in the chemical anatomy produce within cells "idiogenic osmols,"¹⁶ presumably derived from the dissociation of complex intracellular ions or proteins. In brain, this process appears to go on to a significantly greater degree than in muscle because of the relative exclusion of sodium. This metabolic defect, if sufficiently intense, may itself result in permanent neurological damage, and even death.

Adequate treatment of hypernatremia depends on its early recognition. If proper fluid replacement therapy is instituted early,¹⁷ some of these devastating neurological complications may be avoided. An awareness of this problem should result in more careful follow-up and judicious management of those conditions leading to the development of hypernatremia.

Summary

The clinical, laboratory, and pathological findings in three infants with neurological disorders due to dehydration and hypernatremia are described.

Important neurological manifestations of hypernatremia are alterations of consciousness, tremulousness, muscle twitching, and frank convulsions. Possible causative mechanisms of these brain hemorrhages are discussed.

The relative significance of these structural vascular lesions is compared with that

of chemical alterations associated with hypernatremia.

It is emphasized that adequate treatment of hypernatremia depends on its early recognition.

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Myeloradiculoganglionitis Following Zoster

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Cases of myeloradiculoganglionitis following zoster have been reported by Wohlwill,⁵ Schuback,⁴ Riser and Sol,³ and Gilpin, Moersch, and Kernohan.¹ In three of the cases the process was verified histologically. In two of them (Wohlwill⁵ and Schuback⁴) thoracic zoster, and in one (Gilpin, Moersch, and Kernohan¹) frontal zoster, was followed by a ganglioradicular process. A nonfatal case was that of Riser and Sol³; zoster of the chest in a 30-year-old man, followed by flaccid tetraparesis three months later. In another three months the patient recovered.

A nonfatal case at our clinic was observed by one of us (G. P.). Since it has been reported only in Hungarian, it has seemed to us worth publishing in the international literature, together with another case in which fatal outcome made histologic examination possible.

Report of Cases

CASE 1.—A 63-year-old woman was admitted to the clinic on March 18, 1950. When 17 years old she had had erysipelas. At the age of 31 an ovarian tumor was removed.

Between the ages of 46 and 53 she suffered frequently from acute abdominal pain. She was hospitalized at the Clinic for Internal Medicine (Pécs), where a diagnosis of calculous cholecystitis or pancreatitis (?) was made. At the age of 51 she was operated on for intestinal obstruction. For 20 years prior to admission she had had typical attacks of migraine.

On Feb. 18, 1950, she felt a burning pain in the right side of her back. Three days later crops of vesicles appeared under the right breast and in the middle of her back. The eruptions dried up after 10 to 12 days. At the time of the eruptions her gait was unsteady for some minutes.

On admission the typical eruptions of zoster were seen in the region of the sixth and seventh

thoracic dermatomes. Physical examination of the thoracic and abdominal organs failed to reveal any pathologic change. The blood pressure and the urine were normal. The erythrocyte sedimentation rate was 21 mm. in one hour. Blood studies revealed no abnormality. The Wassermann reaction of the blood was negative. Neurologic examination revealed slight diminution of power in the elbow flexors and the hand on the right, hypesthesia to all qualities of sensation in the right sixth and seventh thoracic dermatomes, and unsteadiness on walking with the eyes closed. The cerebrospinal fluid was not examined in the first two weeks. The patient received injections of thiamine and anodynes and a course of x-irradiation (400 r) of the midthoracic intervertebral ganglia of the right side.

The thoracic pains diminished in the third week of clinical treatment, but the patient began to complain of a painful sensation, as of a belt around the waist. A week later muscle power was found to be decreased in the flexors of the thighs, and still more markedly in those of the knees, so that the patient could not walk unassisted. The muscles of the lower extremities were hypotonic; the tendon reflexes and the plantar reflex were absent on both sides. Hypesthesia for all qualities of sensation was found also over the third to the fifth lumbar and first and second sacral dermatomes, being accentuated in the distal parts. Lumbar puncture at this time revealed normal pressure, 9 cells per cubic millimeter, and a total protein content of 146 mg. %. The mastic reaction was 0000115533. The Wassermann reaction of the cerebrospinal fluid was negative.

Vitamin B, ascorbic acid, and nicotinic acid and three further x-ray treatments, each of 100 r, were administered. The patient became progressively better.

Three months after the manifestation of paresis (July 2) she was discharged, with occasional dull, pricking, or throbbing pains in the zoster scars and sharp, burning sensations in the right thigh; the toes felt stiff. The gait was slightly unsteady. The power in the elbow flexors, hand muscles, and the hip and knee was slightly diminished on the right. The ankle jerk and the abdominal and plantar reflexes were still abolished, whereas the knee jerk had returned on both sides. The hypesthesia was confined to the sixth and seventh thoracic dermatomes and to the toes.

Accepted for publication June 5, 1958.

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In January, 1958, she reported that during the months following her discharge she recovered completely. On March 10, 1957, she had an apoplectic seizure, followed by left-sided hemiparesis. At present her only complaint is occasional burning sensations approximately at the site of the zoster scars. On examination, moderate arterial hypertension and slight residual left-sided hemiparesis of the Wernicke-Mann type were found. There was slight hypesthesia in the right sixth thoracic dermatome.

CASE 2.—A woman aged 53, on April 28, 1953, experienced shivering, nausea, and severe pains in the left half of the abdomen. On April 30 a number of vesicular eruptions, with red halos and arranged in groups, developed on the left side of her back and abdomen. The affected area was very painful and burned severely. On May 7 she felt numbness in her legs and walked with difficulty, and by the evening of the same day her legs had become paralyzed. On May 8 she was unable to sit up and the upper extremities also became weak. On May 9 her voice became hoarse and she could swallow and speak only with difficulty.

On admission, on May 10, there were numerous vesicular eruptions in the 11th and 12th thoracic dermatomes on the left side. Physical examination revealed no pathologic changes in the internal organs. On neurologic examination the reflex of the soft palate and that of the pharynx were found to be sluggish. The speech was thick and slurred. The power of the cervical muscles was moderately diminished. The muscles were flaccid in all extremities. She could not move the lower extremities at all, and the muscle power in the upper extremities was greatly diminished, especially on the left. The tendon reflexes could not be elicited either in the upper or in the lower extremities. The plantar responses and abdominal reflexes were absent. Hypesthesia for all qualities of sensation was found over all dermatomes distal to the fifth cervical dermatome, its intensity being accentuated in the distal parts of the body, especially in those distal to the sixth thoracic dermatome.

The blood counts, the sedimentation rate, and the urine were normal. Examination of the cerebrospinal fluid revealed 14 cells per cubic millimeter, with 11 lymphocytes and 3 leukocytes, per cubic millimeter, and a total protein content of 24 mg. %. The Wassermann reaction of both the blood and the cerebrospinal fluid was negative.

On May 11 the patient was able to whisper and swallow only with great difficulty, and complained of a choking sensation. Mucus was removed from the larynx by suction and oxygen was administered, but her condition deteriorated progressively, until on the morning of May 12 she died.

Autopsy revealed a minimal cicatricial thickening of the mitral valves and a slight increase in the fat content of the liver.

Histologic Examination of Nervous System

Spinal and Gasserian Ganglia.—Nissl method: right 11th thoracic; right and left 12th thoracic. Spielmeier and Sudan stains: Bielschowsky's impregnation: right 10th and 11th thoracic; 1st, 2d, and 3d lumbar; 2d and 3d sacral; left 2d and 5th lumbar and 1st sacral; right and left Gasserian ganglia.

Lymphoplasmocytic infiltration, of varying extent, can be seen occasionally in the vessel walls and perivascularly, but also diffusely (Fig. 1).

Fig. 1.—Infiltration in the ganglia, in the roots, and in the connective tissue surrounding the ganglia, its degree being about the same in the left T-11 (A), left T-12 (B), and right T-12 (C) ganglia. Nissl stain; reduced to 66% of mag. $\times 21$.



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In the infiltrations the number of the histiocytes is also increased. There is proliferation of the Schwann cells. In some places the connective tissue surrounding the ganglia also shows massive infiltration.

The infiltration is of about the same intensity in the various sacral and lumbar segments. It increases in the 1st lumbar ganglion (right) and becomes very dense in the 12th thoracic ganglia. No marked difference can be found between the infiltrations of the two 12th ganglia (Fig. 1B, C), and the density of the infiltration in the left 11th ganglion (Fig. 1A) is not of much slighter degree than in the 12th. As far as can be judged from the Sudan-hematoxylin slides, the infiltration seems to be of a less severe degree in the right 11th ganglion. However, it is still very marked in the 10th (right).

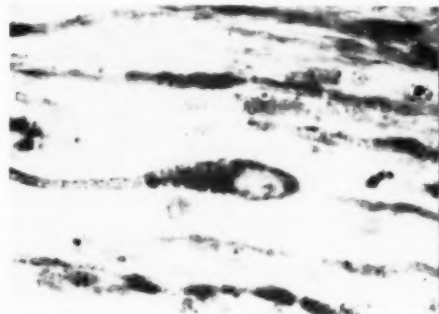
In many of the ganglion cells the tigroid substance is broken down into fine, sand-like particles; sometimes the nucleus lies in the periphery and is swollen, showing the picture of axonal lesion. Chiefly in the lower thoracic ganglia, there is proliferation of the capsular cells of the spinal ganglia, occasional ganglion cells being replaced by them.

Many medullated fibers of the ganglia and of the neighboring zones of the roots, inclusive of the anterior roots, show degenerative changes, such as swelling, balloon formation, and beginning fragmentation. The inflammatory process extends into the roots.

In fat preparations of the sacral and lumbar ganglia the myelin sheaths show definite, but mainly initial, signs of fatty decomposition (Fig. 2), in the form of fat droplets, part of which occur in Schwann cells.

In Bielschowsky preparations, both in the ganglia and in the neighboring root zones, a number of fibers are thickened, sometimes considerably, sometimes diffusely, and sometimes in the form of varicosities, "rosary-like" (Fig. 3). Fragmentation can be observed only sporadically.

Fig. 2.—Left L-2 spinal ganglion, showing disintegration of myelin sheaths. Combination of Spielmeier and Sudan stains; reduced to 66% of mag. $\times 440$.



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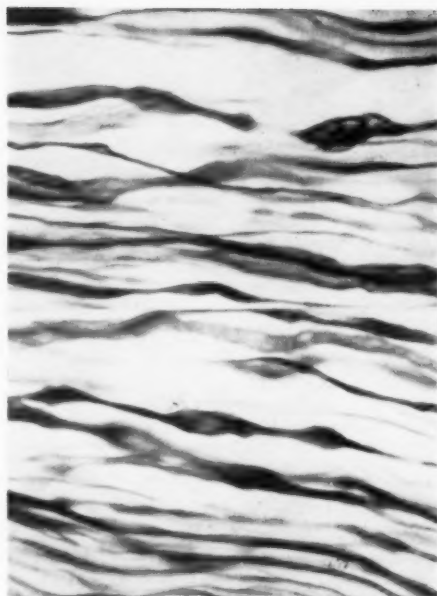


Fig. 3.—Left S-1 spinal ganglion. Varicosities and efflorescence of neurites. Bielschowsky impregnation; reduced to 80% of mag. $\times 1,060$.

The degenerative changes, particularly the neutral fat content of the ganglia, gradually diminish from the low sacral levels upward. In the 11th thoracic ganglion (right) neutral fat is only occasionally seen, although here the infiltrative process is very serious, and presumably is connected with the segmental localization of the zoster eruptions.

Spinal ganglia coming from higher segments were not studied. But portions of the 10th (left) and 7th thoracic, and 5th cervical roots passing through the dura were examined. Slight infiltration and demyelination of the intra- and extradural parts could be seen also in the 7th and 10th thoracic but not in the 5th cervical root.

There is moderate infiltration, even in the Gasserian ganglia. Some myelin sheaths are swollen, without definite signs of decomposition.

In order to find out how far the pathologic changes had extended proximally along the roots, a portion of about 2 cm. of the second lumbar root was examined in longitudinal sections. In the interstitium of this section there is mild infiltration. Fatty breakdown can be seen in only one place; here, also, the infiltration is more pronounced. Furthermore, examination of the Spielmeier and Sudan preparations of a block containing the cross sections of all the cauda roots at a distance of about 5 cm. from the conus medullaris revealed only a small number of neutral fat drops in a

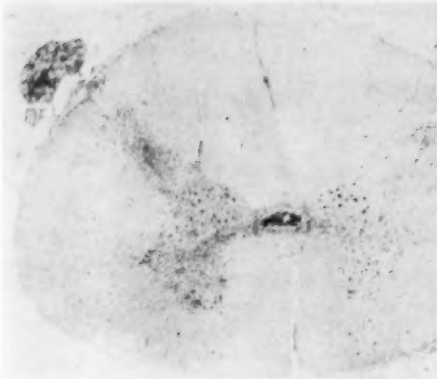


Fig. 4.—Spinal cord: T-12. Vascular and tissue infiltration on the left side. The entering posterior root shows severe infiltration. Nissl stain; reduced to 76% of mag. $\times 14$.

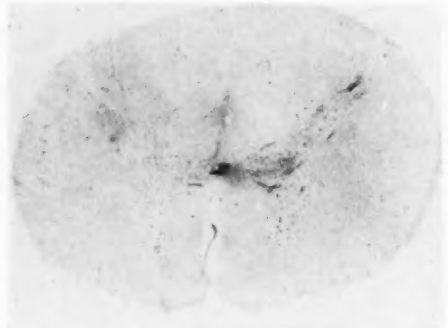


Fig. 5.—Spinal cord: T-11. Infiltration in the left posterior horn (at right) and the intermediary part of the gray matter. Nissl stain; reduced to 76% of mag. $\times 13.5$.

single root. In the left 12th posterior root, however, some yellowish droplets can be seen in a bundle just before it joins the cord.

Spinal Cord (C-1, C-3, C-5, C-8, T-4, T-11, T-12, L-2, L-3, and bulb).—In the 12th and 11th thoracic segments there are vascular infiltrations and diffuse, as well as focal, glial proliferation on the side (left) of the zoster eruptions. These changes are almost entirely restricted to the gray matter, where they are present in the anterior horn and in Clarke's column, but are more pronounced in the posterior horn (Figs. 4 and 5). In the anterior and lateral horns some of the ganglion cells are in a state of axonal change (Fig. 6).

In the anterior and posterior roots, just before their insertion in the cord, the number of septal cells and their plasma are increased. The pathologic changes of the posterior root are more pronounced than those of the anterior root. The left 12th pos-

terior root is very seriously affected. In the walls of its vessels there is also lymphocytic infiltration (Fig. 7).

In the lumbar cord in the left posterior funiculus there is a loose, but extensive, glial focus dorso-medially, in connection with infiltration of the septal vessel.

Scanty vascular and glial infiltrations, always remaining unilateral and affecting only the posterior horn and funiculus, exceptionally the gray commissure, can be followed up to the cervical segments. Glial foci can be found occasionally at the level of the decussation of the pyramids in one side of the posterior horn and in Goll's nucleus. Scattered mild axonal changes are seen in some bulbar nuclei, but never in the nucleus of the nervus hypoglossus.

No degenerative changes can be found in the Spielmeyer and Sudan preparations of the spinal cord.

Fig. 6.—Anterior horn of the T-12 segment. Slight glial proliferation and axonal change of a large motor cell. Nissl stain; reduced to 76% of mag. $\times 80$.

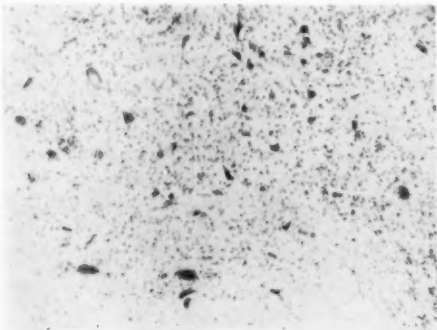
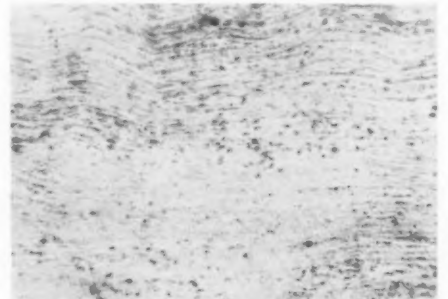


Fig. 7.—Fatty decomposition in the left 12th intercostal nerve. Sudan-hematoxylin stain; reduced to 76% of mag. $\times 88$.



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The pia is infiltrated with lymphocytes, mainly on the posterior surface of the cord and at the insertion of the posterior roots. The amount of infiltration changes with the different segments.

A mild lymphocytic infiltration may be seen also in one of the hypoglossal roots.

Cerebrum and Cerebellum.—Transverse sections of the pons, midbrain, basal ganglia, and cerebellar hemispheres, as well as sections of several cortical regions, proved entirely free from pathologic changes. Only slight leptomeningeal infiltrations could be followed cephalad as far as the pons.

Peripheral Nerves.—Spielmeyer and Sudan stains; Bielschowsky impregnation: Preparations were made of the left 10th, left and right 12th intercostal, left tibial and common peroneal, right deep peroneal, left radial, and right ulnar nerves.

The most severely affected nerve is the 12th intercostal of the left side. Infiltration and breakdown of the myelin sheaths have taken place to a great extent. The fatty decomposition here is also more advanced than in the spinal ganglia (Fig. 7). In the silver-impregnated preparations thickening, tortuosities, and, occasionally, fragmentation of the axons can be observed. But the lesions of the myelin sheaths outnumber these of the axons.

The pathologic changes of the right 10th and 12th intercostal nerves are of a considerably slighter degree.

Comparison of the sciatic nerves and their branches shows that the gravity of the degenerative changes lessens toward the periphery. While there is fairly extensive fatty decomposition in the two sciatic nerves, it is absent in the tibial and peroneal nerves. Of the infiltrations, the same cannot be definitely stated. The radial nerve shows a moderate degree of the above-mentioned changes.*

Comment

In our first case, that of a woman aged 63, flaccid paresis and sensory disturbance of the distal type developed in the lower extremities about two months after thoracic zoster. In a few months nearly complete recovery occurred.

In our second case, a thoracic zoster was followed by paresis of the extremities in seven to eight days. The patient, a woman aged 53, died of respiratory paralysis on the 12th day after the appearance of the skin eruptions.

In Case 1, as in those of Wohlwill,⁵ Gilpin, Moersch and Kernohan,¹ and Riser

and Sol,³ the cerebrospinal fluid presented the Guillain-Barré syndrome, while in Case 2 it was free from pathologic changes.

In the verified case the main site of the histologic changes was the sensory ganglia and the left 12th intercostal nerve. From the ganglia the process had extended to the anterior and posterior roots, and the peripheral nerves.

The gravity of the ganglionic process should be considered in the light of the infiltrative changes and of the parenchymal lesion, which consists essentially of an alteration of the medullated fibers. Lymphoplasmocytic infiltration is of about the same intensity in the sacral and in the lumbar ganglia. It becomes very intense at the levels and on the side of the zoster eruptions and is present even in the Gasserian ganglion, though in a much less pronounced degree than in the more caudal segments. The lesion of the medullated fibers, consisting chiefly of changes of the myelin sheaths and only in a slighter degree of the sheaths of the axons, decreases from the sacrolumbar ganglia cephalad.

Obviously, the degree of involvement of the peripheral nerves depends on two factors, one being their location in relation to the skin changes and the other their distance from the ganglia. The severity of the lesion of the left 12th intercostal nerve corresponds to the location of the eruptions, while in the other peripheral nerves the changes diminish distally, as may clearly be seen in the case of the sciatic nerves and their branches.

In the spinal cord morbid changes were found only on the left side, i. e., the side of the zoster eruptions. Apart from the axonal cell changes, the spinal cord showed only inflammatory signs, which were most serious in the 11th and 12th thoracic segments. Cephalad, the process decreased in severity; only slight meningeal infiltration could be followed as far as the pons. (The fibrogenic glial proliferation corresponds to the age of the patient and obviously has no connection with the morbid process.)

The fact that the most pronounced inflammatory changes in the spinal cord segments

* These changes are absent in the ulnar nerve, at least in its distal portion.

and in the intercostal nerves can be seen at the level of the eruption might be taken to prove the direct neural propagation of the process caused by the zoster virus. The accentuation of the inflammatory changes in the left 12th posterior root also supports this view.

Furthermore, the significance of the peripheral sensory neuron for the propagation becomes evident through the fact that in the spinal cord and bulb the inflammatory changes follow the route: posterior horn—posterior funiculus—Goll's nucleus. The only exceptions are the most severely affected segments, in which the anterior horn and Clarke's column are also involved. This represents a feature of zoster cases which has been described by several authors since it was first recognized by Wohlwill,⁵ in 1924, that the inflammatory changes of zoster might extend into the spinal cord. Lhermitte and Nicolas² suggested the term "zoster myelitis" in 1931. On account of these findings, we think it possible that in our case, too, the changes in the spinal cord may be due to the propagation of the zoster infection from the periphery.

The ganglioradiculitic process outside the segments which are in no connection with the peripheral zoster process decreases in intensity in a caudocranial direction, mainly as far as the degenerative component is concerned. Thus, it remains an open question whether in such cases Landry's paralysis is caused by the spread of the zoster infection or whether a "symptomatic" zoster is superimposed on a process originally beginning as polyganglionitis. Either course should be considered possible.

Summary

The clinical picture of a benign case of polyganglionitis following thoracic zoster and the clinical and histologic findings of a similar, but fatal, case are reported.

In the fatal case inflammatory, as well as degenerative, signs were found. The inflammatory process is most marked at the level and on the side of the skin changes in the spinal ganglia, in the cord, and in the intercostal nerves, while the sacral and lumbar spinal ganglia show infiltrative changes of a less intensity. The inflammatory process can be followed with diminishing degree cephalad. The very severe changes in the left 12th intercostal nerve and posterior root are in connection with the site of the skin eruptions. The severity of the lesion to the medullated fibers of the other peripheral nerves diminishes toward the distal portions. Degenerative changes of the ganglia decrease from the sacral levels cephalad.

On the basis of the clinical and histologic picture, it cannot be decided whether polyganglionitis was caused by the spread of the zoster infection or whether skin eruptions of the zoster associated themselves with a process originally beginning as polyganglionitis.

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Observations on Current Therapy of Abscess of the Brain

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Purpose and Introduction

More than 10 years have elapsed since antibiotic agents became generally available in the treatment of pyogenic disease of the central nervous system. Several authors¹⁻⁴ have reported that these agents have lowered the mortality rate in abscess of the brain. However, the surgical management of this type of abscess varies, and may play a role in the outcome in the individual case.⁵ In an attempt to evaluate this factor, we undertook the present study.

Materials and Method

The records of patients who underwent surgical treatment of intracerebral pyogenic disease at the Mayo Clinic in the years 1946 through 1955, inclusive, were studied. The results of culture and the sensitivity of the micro-organisms to various antibiotic agents were noted, and the antibiotic agents used in treating the patients were recorded. The surgical procedures were indicated by the surgeon's description of the operation dictated immediately after completion of the procedure. These factors were correlated with the outcome with respect to deaths or to ultimate morbidity of survivors.

Operative Procedures

In the years 1946 through 1955, inclusive, 60 patients who had abscess of the brain were treated surgically at the Mayo Clinic by a total of 65 operative procedures. The operative procedures have been classified by us in the following three categories: resection, resection and irrigation, and

drainage. In all cases appropriate antibiotic agents were administered parenterally, and in some instances intrathecally.

Resection.—When the diagnosis of abscess of the brain could be made on the basis of the clinical picture, large doses of the proper antibiotic agents were administered preoperatively for several hours while other preparations for operation were made. The patient was then taken to the operating theater, and, after the abscess had been located, craniotomy was performed at the site of the lesion. The abscess was excised in a manner similar to that used for removal of a tumor of the brain, precautions being taken to avoid unnecessary soiling of the operative field by the purulent contents of the lesion. After establishment of hemostasis, the cavity was filled with an antibiotic solution, and the wound was closed without drainage.

Resection and Irrigation.—In some cases, because of urgency indicated by the patient's condition, or occasionally because of the uncertain nature of the intracranial expanding mass, antibiotic agents were not given preoperatively in sufficient amounts to permit, in the opinion of the individual surgeon, closure of the incision without additional local treatment. In such a case, after the abscess was resected and the cavity filled with antibiotic solution, the tip of a catheter was placed in the bed of the abscess so that the catheter extended through the craniotomy incision, which was then closed tightly around it. The catheter was kept closed except when an antibiotic solution was injected periodically into the bed of the abscess during the postoperative period.

Drainage.—Abscesses which, in the opinion of the individual surgeon, were not suitable for resection were drained. In some cases a catheter was left in the cavity of the abscess for the intermittent instillation of antibiotic solution. In this category are included all surgically treated abscesses of the brain which were not resected.

Results

Abscesses of the brain in the present series were distributed in approximate proportion to the mass of the various parts of

Received for publication April 25, 1958.
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the brain affected. That is, the frontal lobe was the seat of an abscess 28 times, the temporal lobe, 15 times, the parietal lobe, 13 times, the occipital lobe once, and the cerebellum 6 times. Abscesses were known to be multiple in three cases.

The results of culture of material from the abscesses are shown in Table 1. Patients

TABLE 1.—*Abscess of the Brain, 1946-1955: Organisms Produced by Culture of Contents*

Culture, Result	Times Noted, Total	Hospital Deaths	
		Number	Per Cent
No growth	10	1	10
Staphylococcus	18	1	7
Streptococcus	21	5	28
Gram-negative rods	8	1	12
Bacteroides	2	0	
Corynebacterium	2	1	
Nocardia	1	1	

with abscesses from which several species of organisms were obtained by culture fared no worse than did those whose abscesses yielded only one species by culture. Gram-negative bacilli were encountered twice in association with a Gram-positive coccus, and *Staphylococcus aureus* and streptococci were encountered in mixed culture three times. These organisms are listed separately in Table 1 to indicate their relative effect on the mortality rate. No result of culture was available in two cases.

TABLE 2.—*Abscess of the Brain, 1946-1956: Treatment in Respect to Deaths in Hospital*

Treatment	Total	Hospital Deaths	
		Number	Per Cent
Resection	21	4	19.1
Resection and irrigation	16	4	25.0
Drainage	23	2	11.5
Total patients operated upon	60	10	16.7

Mortality rates among patients treated by the various surgical methods are given in Table 2. Five patients underwent multiple operations; in these cases the final surgical procedure is regarded as the one responsible for survival of the patient. Of abscesses

drained originally, two required another drainage procedure, and one was resected electively (listed as "resected" in the Table). All patients in the afore-mentioned group recovered. Of abscesses originally resected, two recurred and were drained. The patients recovered. One abscess possibly recurred, but the patient recovered without another operation, after intensive antibiotic therapy. In this series only one chronic abscess was encountered unexpectedly, and this lesion was resected.

It is of interest that of the 29 patients who underwent resection of a single abscess of the brain, 4 died of the disease, a mortality rate of 13.8%. Of the 21 patients who had a single abscess that was drained, 1 died, and 1, taken from the hospital by his relatives while he was moribund, probably died, resulting in a mortality of 9.5%. No patient in this series recovered from multiple abscesses of the brain.

The effect of antibiotic treatment on the mortality rate accompanying abscess of the brain is seen in Table 3. The antibiotic

TABLE 3.—*Effect of Antibiotic Treatment After Operation for Abscess of the Brain*

Agent	Total	Hospital Deaths	
		Number	Per Cent
Penicillin	5	2	40
Penicillin, sulfonamide (10 drained)	16	1	6
Penicillin, streptomycin	12	2	17
Penicillin, streptomycin, sulfonamide	11	2	18
Tetracycline hydrochloride, penicillin, streptomycin, and sulfonamide	15	2	13

agents prescribed were indicated on the basis of results of sensitivity tests conducted with the organisms isolated from the respective abscesses. A combination of available antibiotic agents was used until the sensitivity of the micro-organism in question was known. The mortality rate for the years 1946 through 1950 was essentially the same as that for the years 1951 through 1955. Deaths were associated with either multiple

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TABLE 4.—Incidence of Postoperative Seizures After Operation for Abscess of the Brain*

Treatment	Total	Seizures	
		Number	Per Cent
Resection	11	4	36.4
Resection and irrigation	9	4	44.5
Drainage	12	5	41.7
Total patients operated upon	32	13	40.6

* In six cases a cerebellar abscess was present; the six patients did not experience postoperative seizures.

abscesses or a recurrence of the original abscess.

In Table 4 may be seen the incidence of postoperative seizures after the treatment for intracerebral abscess. All the six patients who had cerebellar abscess recovered, and none exhibited a convulsive disorder.

Comment

Several points are worthy of further consideration. First, the mortality rate accompanying streptococcal abscess in this group of patients is greater than that accompanying abscesses caused by other micro-organisms. We are unable to explain this finding.

Next, in this series, as in others,^{3,5} a large number of abscesses apparently were sterile, and yet the mortality rate associated with such lesions was as great as that caused by abscesses from which organisms were obtained by culture. In the formation of an abscess, liquefaction of tissue results from the proteolytic enzymes released by disintegrating leukocytes and possibly the result is an area of increased osmolarity, which expands by attracting water. This mechanism may well be active, whether or not the natural defenses of the body, aided by antibiotic agents, have rendered the area sterile. Thus, it may be that a sterile abscess of the brain continues to expand, and thereby to produce edema and increased intracranial pressure, and possibly even rupture into a ventricle or into the subarachnoid space.

It is evident from this study, as well as from other studies, that the intelligent use

of antibiotic agents has markedly lowered the mortality rate associated with abscess of the brain to the present percentage of less than 20. Such a reduction, however, has been possible when antibiotic agents were used in conjunction with surgical eradication of the purulent focus. We cannot, on the basis of the present data, generalize as to the best choice of the several surgical procedures available for the treatment of abscess of the brain.

Summary

The records of patients who underwent surgical treatment for abscesses of the brain at the Mayo Clinic during the period 1946 through 1955, inclusive, were studied. Sixty patients who had abscess of the brain were treated surgically. In this series a chronic abscess was encountered only once. A single abscess was resected in 29 cases, with a mortality rate of 13.8%; a single abscess was drained in 21 cases, with a mortality rate of 9.5%. No patient recovered from multiple abscesses of the brain. The use of antibiotic agents in conjunction with surgical treatment has lowered the mortality rate accompanying abscess of the brain.

Mayo Clinic and Foundation.

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Deviation of the Head

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Deviation of the head* can occur in different individual planes or combinations of these. Basically, the head can be rotated about the vertebral axis, or the axis may be flexed either ventrally or laterally. Slight deviations are often due to unidirectional displacements, but severe disabilities are usually of compound nature, and it is these which are commonly called torticollis, or wryneck. It is customary to divide torti-

Accepted for publication Nov. 27, 1957.

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Financial assistance was obtained from the Matheson Commission and the National Institute of Neurology and Blindness, U. S. Public Health Service, Grants B-386 (C1) and B-387 (C1 and C2).

* The term deviation of the head requires some elucidation. It is here employed to mean any departure from the normal, upright, forward-looking posture of the head of bipedal primates. The phrases turning and torsion of the head are subject to some misinterpretation not only because the head may be rotated on the cervical axis, and also angulated laterally, but because the head can be said to be turned toward the left when the chin is facing either the left or right shoulder. This is because some authors use the occiput and some the chin as the point of reference. Unless one is told in which direction the chin (or occiput) has been moved, we know little about what is meant when it is said that the head is turned in one or the other direction. When the axis of the cervical vertebrae is flexed, as well as rotated, the ear is a more useful reference point than either the chin or occiput. After destruction of the labyrinth in carnivores (MacKenzie, 1943) the head can not only be rotated so that the dead labyrinth is lower but the jaw can be approximated to the ipsilateral shoulder. Because of the manner in which the head of primate bipeds is fixed, this situation cannot obtain in such forms. In MacKenzie's cats curvature of the spine, with the concavity to the affected side, and rotation of the spine "to" the operated side was seen (i. e., falling toward that side).

colles into those due to local muscular, labyrinthine, or central neural causes. To these must be added those due to, or complicated by, skeletal or dermal involvement, but such interpretative classifications must be converted into observational equivalents before they are of any immediate value to the clinician who has a patient before him. For this reason it is useful not only to distinguish between deviations of the head which are of a sustained (tonic torticollis), as contrasted with a clonic (spasmodic torticollis), nature, but also to determine whether the condition is alterable (either by the patient himself or by passive movement) or unalterable, was of sudden or gradual onset, is acute or of notable chronicity, whether a positive family history exists with regard to any form of neuropsychiatric disturbance, whether an infection is or has been present, and to what degree the patient's personality is unstable. In all such cases one will also wish to determine whether the disorder is painful or painless and whether it is the only evidence of disturbance or exists in association with other abnormal findings.

Sustained Cephalic Deviations Unrectifiable by Passive Movement

In this class of disorders the head is held in an abnormal position which cannot be corrected either because of restriction in the range of movement or because of the pain produced. With the exception of one variety, such torticolles as are due to involvement of the superficial tissues require no extended consideration. In most cases the condition is of traumatic origin; its cause is apparent, and it is easily remedied. Where, however, the restriction in movement is due to scleroderma or progressive

DEVIATION OF HEAD

facial hemiatrophy, effectual treatment may be impossible. The tilting of the head seen in these conditions is only incidental to other, very severe changes elsewhere, and these should be even more apparent and are more disabling than the cephalic deviation, which may not be present in all instances of scleroderma or progressive facial hemiatrophy.

Where no superficial structural abnormalities exist and movement is unrectifiable because the patient experiences real pain upon attempted passive movement, such pain is rarely present in the initial phases of passive, slow movement and either is not present at all over certain ranges of the movement or occurs only when the head is moved suddenly. If a patient complains of pain in all ranges and at all speeds of movement and the muscles do not appear to be painful when directly and judiciously palpated, in an inconspicuous manner, malinering or a personality disturbance should be suspected. One should also suspect such situations when increasing resistance is offered to passive movement in nonpainful torticollis, since true muscular rigidity is equally well maintained throughout the entire range of passive movement and does not increase when the force of such passive movement is increased.

Sudden, painful, more or less fixed deviation of the head, especially if it arose in association with exercise or a sudden turning movement, should lead one to suspect a cervical dislocation, rupture of the sternocleidomastoid muscle or avulsion of it from its attachment, or hemorrhage into the fascial sheath of that muscle. Cervical caries, now fortunately rare, may manifest itself in rather sudden torticollis, either with or without a previous history of cervical pain, but a brief history of soreness and stiffness preceding the development of a torticollis, especially if definite muscle spasm can be demonstrated, usually points toward the existence of an inflammatory process or enlargement of the deep cervical glands. Recurrent or chronic, painful torti-

collis should direct one's attention to progressive diseases of the vertebrae.

In chronic cases without pain it is necessary to distinguish between congenital types and those of later onset. Among the former, neurologic varieties must be differentiated from myopathy due to rupture of the sternocleidomastoid muscle during a shoulder or other obstetrical presentation. The existence of a palpable callus in the body of the muscle at its site of rupture does not eliminate the possibility of a concomitant congenital torticollis of neurogenic origin. Most children with torticollis due to congenital shortening of the cervical muscles (sternocleidomastoid and/or deep cervical muscles and trapezius) show some secondary abnormality of the bones which must be distinguished from primary developmental defects of these. Such patients also display more or less facial asymmetry, due to underdevelopment of the face on the affected side. This does not necessarily bespeak the existence of neurologic abnormality and requires to be distinguished from the very rare progressive facial hemiatrophy mentioned above.

Where a painless asymmetrical restriction of movement is apparent and no congenital abnormalities are apparent in the muscles of the neck, such abnormalities should be sought in the occipital bone (platybasia and fusion with the atlas) and cervical vertebrae (synostosis of first two vertebrae, Klippel-Feil deformity, wedge-shaped vertebrae, and cervical ribs). Obviously, roentgenographic examination of the cervical vertebrae will be carried out in all older individuals in whom a "tonic" or "sustained," incorrigible, painless torticollis has gradually developed over a period of years.

Sustained Cephalic Deviation Rectifiable by the Patient or by Passive Movement

Abnormal postures of the head which are rectifiable, particularly those rectifiable by the patient himself, disclose the possibility that the abnormality in posture may be of a more or less unconscious compensatory

type rather than an obligatory pathologic result. Halpern (1954) has explored the effect which alterations in the position of abnormal head postures have upon the sensorimotor manifestations of disequilibrium and has emphasized the fact that returning the abnormally positioned head of such cases to the "normal" position may aggravate not only the motor but also the sensory difficulties of the patient. Rectifiable abnormal head positions may therefore be regarded not merely as a direct result of disturbed motor outflow but also as one of the many compensatory attitudes which the organism adopts to offset disturbances in function.

Many maintained deviations of the head are easily corrigible by the individual himself or by the application of very slight pressure by the observer. Postural deviations of this type are seen in cases with visual field defects, imbalance of the extraocular muscles, supratentorial cerebral lesions not affecting the occipital cortex, and lesions of the infratentorial brain stem and spinal cord. In deviations due to lesions of the first three types noted above, the head (chin) is turned in the direction of the defect. Thus (Fig. 1), with supratentorial lesions the head, and eyes also, are directed toward the side of the lesion whether or not a visual field defect exists (Mettler, 1943). If one of the extraocular muscles is weak, the head is deviated in the direction toward which the paretic muscle should deviate the bulb. That such positions are due to an extraocular palsy can be demonstrated by moving the head in the direction opposite to that assumed. When this is done, a diplopia will develop, and the bulbi will display a divergence in the direction of gaze.

Deviation Due to Spinal Cord Lesions

Lesions of the spinal cord produce cephalic deviations when the motoneurons supplying the cervical muscles are directly involved. Any pathologic process in the first five cervical segments may produce such an effect, since both the sternocleid-

ANIMAL	23	24	49	36	33	31	35
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DEVIATION OF HEAD

Summarizing the findings following lesions of vestibular pathways from the inner ear to the vestibular cerebellar cortex, according to data from current literature.

UNILATERAL LESION OR SEVERANCE OF:		LABYRINTH OR VIII NERVE (MORTENTON AND BARRETT, '34)	LABYRINTH (DOW, '38)	MEDIAL VESTIBULAR NUCLEUS (FERRARO, FACELLA AND BARRETT, '40)	INTRA-MEDULL. JUXTA-RESTIF. BODY (FERRARO AND BARRETT, '36)	SUPRA-MEDULL. JUXTA-RESTIF. BODY (SAME)	SUPRA-MEDULL. JUXTA-RESTIF. BODY PLUS RESTIFORM BODY (SAME)	NODULUS AND UVULA (DOW, '38a)	NODULUS AND UVULA AFTER LARYNTH-ECTOMY (DOW, '38a)
During gait, running, climbing, swimming	Falling	I	I (forced)	I	I	C ±	I	C (I after fifth day)	
	Rolling	I	I	I	I	—	I	C	
	Spiraling	I	I	I	I	C	I	C	C
Deviation occiput (opposite to chin deviation)		I	I	I	I	C ±	C	C	C
Side of flexed limbs (extended to other side)		I	I plus adduct. (contral. abd.)	I	I	—	I		
Deviation of eyes			I					C	
Slow component nystagmus		I	I	I	I	C	C	C	
Induced nystagmus		I lost	I lost	I impaired				Normal	
Loss of orientation when swimming under water or blindfolded		+	+	+	+	—	+	No	
Righting reflexes		I lost	I impaired	I impaired				Normal	
Decreased resistance to passive movements		I	No	I		I ±	I	No	
Hyporeflexia		I	No	I		I ±	I	No	
Unsteady gait		+	+	±	+	±	+	++	
Ataxia of limbs				—	—	—	—	—	
Recovery		Slow Incomplete	Slow Incomplete	Slow	Slow	Fast	Slow	Slow Complete	
		I — Ipsilateral		+ — Present				± — Slight	
		C — Contralateral		++ — Severe				— — Absent	

Fig. 2.—Self-explanatory table from Carrea and Mettler (1947).

away from the vector of the separate directions of force of the two muscles supplied (the head thus rotating its chin toward the side of the lesion and falling somewhat forward, with the sound ear approximating the sound shoulder) but by an inability to hunch the shoulder on the affected side. If more or less involvement of the functions of the bulbar part of the accessory and 9th and 10th cranial nerves is also encountered, it may be assumed that the location of the lesion is in the posterior fossa rather than the vertebral canal.

Posterior Fossa Lesions

Lesions in the posterior fossa produce the most puzzling varieties of cephalic deviation. According to the older literature, the "center" for head turning lay in the mesencephalon, but Magnus (1924) stated that, in rabbits, the afferent impulses for the specific reflex of head-turning originate in the cristae of the semicircular canals and are conducted through the rami ampullares of the vestibular branch of the eighth cranial

nerve to a medullary "center," which lies entirely caudal to the upper level of entrance of the eighth nerve. The medial longitudinal fasciculi can be partially destroyed, he said (meaning, no doubt, caudal to this level), without abolishing the reflexes of head-turning. Rademaker (1926), working with rabbits and cats, concluded, as had Magnus, that the essential mechanisms for head-turning do not lie in the cerebellum or red nuclei nor rostral to the latter and do not utilize the rubrospinal tracts, but he thought they might lie in the dorsal part of the mesencephalon, in the vicinity of the caudal part of the red nucleus. The responsible paths, he ventured, were not entirely crossed. He also thought the afferent fibers of the trigeminus might be of importance in mediating reflex turning of the head.

One of the difficulties encountered in evaluating the very old literature in terms of the researches of Magnus and of Rademaker is due to the facts that the latter were concerned with the retention of *any degree of ability* to turn the head, and reflex head-

turning may be still elicitable in situations which are far from compatible with normal positions of the head. That work was done, moreover, before the distinction between the vestibular and the non-vestibular parts of the cerebellum was clearly understood (Dow, 1938a).

Lesions of Vestibular System

The basic cephalic deviation in brain stem lesions is that which is encountered after total deprivation of labyrinthine influences. This results, in quadrupeds, in a position in which the dead labyrinth is rotated to a position between the head and the earth. In other words, the occiput (such animals can scarcely be said to possess a chin) is rotated toward the side of the lesion. In primates, where it is customary to refer head movements to the direction toward which the chin is rotated, this terminology can be confusing. Disconnections of the nuchal muscles of carnivores is enough to produce vestibular imbalance (Mettler and Mettler, 1942) and thus to precipitate further cephalic deviation, but in primates such a procedure is not so incapacitating (Case 19, Mettler, 1944). In primates, any tendency to turn the head is often accompanied by turning of the body, so that monkeys rotate in clockwise fashion after destruction of the left eighth nerve or labyrinth and counterclockwise after destruction of the right, that is, such destruction produces ipsilateral rotation. The eyes are often seen in conjugate deviation toward the side of the lesion but can be moved in all directions.

Dissociation Between Cephalic Deviation, Deviation of Gaze, and Circling

Specific cautions are, however, required in equating deviation of the head with either deviation of the eyes or circling of the body. Usually the direction of ocular deviation is toward the side toward which the chin is directed, but it has long been known that the directions of deviations of the head and eyes may be independent. The ocular position is very variable and bizarre when

lesions fall between (or in) the oculomotor and vestibular nuclear complex. Lateral movements of either eye or both may be abolished, and many exceptions to the general rule can be found. It should also be pointed out that the maintained postures of cephalic deviation seen after cortical lesions are not solely the result of defects in the visual fields. Furthermore, in a study of both circling and cephalic deviation in monkeys with lesions of the cerebellar projections, Carrea and Mettler (1955, p. 295) found that these two phenomena are also dissociable. The territory in which lesions produce head deviation and circling which are not identical in direction is above the decussation of the brachium conjunctivum and below the subthalamic nucleus, i. e., in the mesencephalon—a point of potential diagnostic significance.

Supravestibular Lesions

In animals (such as No. 106 in Mettler, 1944) which have had lesions in what seems to be a critical area (isthmus) the direction of head turning may change from day to day and never become stabilized. Some suggestion as to why such a variation in direction may occur can be obtained from Figure 2 (Carrea and Mettler, 1947), which indicates that there is a shift in the direction of the established deviation of the head which follows unilateral posterior-fossa lesions when one passes from lesions of the labyrinth or eighth nerve (Northington and Barrera, 1934; Dow, 1938) or lesions which might damage this directly, like those of the vestibular nucleus (Ferraro, Pacella, and Barrera, 1940) and intramedullary juxtarestiform body (Ferraro and Barrera, 1936), to supramedullary (Ferraro and Barrera, 1936) lesions or those which involve the vestibular cerebellum (Dow, 1938a). Lesions which lie far lateral in the infratentorial brain stem and do not involve appreciable amounts of the vestibular or rubrospinal systems, such as lesions of the restiform body (Orioli and Mettler, 1956, Case 2531), do not produce any deviations in head posture.

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It is very difficult to weigh the importance of Rademaker's conjecture that the mesencephalic root of the trigeminus is of basic significance in head turning. In our own experiments in which this has been stimulated or destroyed, the head (chin) has turned toward the side stimulated, and away from that destroyed, but it is difficult to avoid involving the upper part of the vestibular complex, the brachium conjunctivum, or other systems in such attacks upon the mesencephalic root of the fifth nerve (Cases 2 and 13, Mettler, 1944).

Analysis of those lesions which produce sustained postures of cephalic deviation reveals that interference with the vestibular nerve or nuclear complex produces turning of the head (chin) away from the side of the lesion. On the other hand, unilateral lesions above the level of the vestibular complex usually result in turning of the head toward the side of the lesion. Thus, such deviation has been seen when the mesencephalon, including the substantia grisea centralis, is hemisectioned, whether the peduncle and red nucleus are excluded (Case 68) or included (Cases 69, 53), when the isthmus is hemisectioned (Case 106), and when large lesions have been placed in the pontine tegmentum (Case 7).†

It is apparent, then, that deviation of the head can be produced by a wide range of influences and that there are many differences in animals which display deviations due to such varying lesions. In some animals the deviation is merely a preferred posture which is easily disturbed. In others it is an habitual position. An increasing urgency in deviation has already been suggested in Figure 1, and this becomes more marked as one progresses caudally. In some cases of infratentorial lesion the posture, though at first marked and well sustained, ultimately becomes less and less pronounced. In other cases, as when a vestibular lesion exists, no amelioration ever develops. Such observations add substance to the conclusions of both Magnus and Rademaker about

the location of head-turning centers but suggest that those conclusions are but partial explanations of a complex function. These workers countenanced few, if any, influences on head turning besides that arising from the vestibular apparatus. Unquestionably, this influence is the fundamental one upon which the basic mechanism of head-turning is erected, and it is abolished by destruction of the location of both vestibular nuclei. (It is the vestibular nuclei, not the nerves or peripheral apparatus, which are important, since head-turning and abnormal postures are still possible when the nerves have been severed or when the labyrinth is congenitally absent.) In this sense, then, there is a ponto-medullary "center" for head-turning which, when intact, allows the performance of this act, but suprapontine mechanisms also are involved, and what is possible with the pontomedullary apparatus alone is only a truncated type of performance. Since such superimposed patterns are relatively complete when the transection of the neuraxis lies just above the red nucleus, it is not surprising that Rademaker envisioned a second "center" in the mesencephalon. He knew that the red nuclei were not essential for head turning; but, in placing the specific mesencephalic cephalogyric "center" in the vicinity of these, he did not effectively eliminate the rubrospinal tract.

Rubrospinal Lesions and the Cerebellar Outflow

The real problem which now faces us is how supravestibular influences responsible for head deviation exert their influence. The two most logical mechanisms would be the rubrospinal or cerebellar outflow. It has been said above that Rademaker cannot be said to have effectively eliminated the rubrospinal tract, for, according to modern conceptions of the origin of this, much of it arises from cells situated outside the red nucleus. We have seen that lesions situated above the pons all produce deviation of the head in the same direction. Such a situation argues against the critical involvement of

† All these cases are from Mettler, 1944.

any system which decussates above the level of the pons, and thus against the necessary participation of the rubrospinal system in head-turning. The rubrospinal is, however, only part of a mechanism which, beginning in the cerebellum, crosses sides in the decussation of the brachium conjunctivum and then, in the rubrospinal decussation, returns to its side of origin. In connection with the present study, the right rubrospinal tract was fulgurated in five monkeys by applying an electrode against the lateral side of the medulla just dorsal to the inferior olive, and thus below the pons. These cases, Nos. 2337, 2340, 2345, 2349, and 2358, are summarized in Figure 3. Case 2337 showed a certain amount of involvement of the right olive also, and in Case 2358 the rubrospinal tract was only partially interrupted. These data demonstrate that rubrospinal damage does not always produce deviation of the head and suggest that, in these cases, the deviation may have been due to inadvertent stretching of the vestibular nerve during the exposure or to the pressure of retraction exerted against the medulla at the time of the fulguration below. The fact that, in one case, the movement was oppo-

ANESUS	HEAD TURN		ENLARGEMENT OF THE MOUTH		FALLS TO		CLONIC CONTRACTIONS		PROPRIO-CEPTIVE REFLEXES		PLANTAR RESPONSE		PALMAR RESPONSE		INTER-OLIVE RESPONSE		INTER-OLIVE RESPONSE		TOTAL SPINAL CORD COMPLETION	
	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R
2337	0	0	0	0	0	0	0	0	N	N	N	N	N	N	N	N	N	36	36	21
2340	0	0	0	0	0	0	0	0	N	N	N	N	N	N	N	N	N	30	30	
2345	0	0	0	0	0	0	0	0	N	N	N	N	N	N	N	N	N	7	7	0
2349	0	0	0	0	0	0	0	0	N	N	N	N	N	N	N	N	N	35	35	0
2358	0	0	0	0	0	0	0	0	N	N	N	N	N	N	N	N	N	35	35	0

Fig. 3.—Diagram of the circumstances observed in the monkeys whose numbers are given herewith, all of which (see text) suffered fulguration of the right rubrospinal tract in the medulla. All these animals exhibited a right-sided hypokinesia, had decreased resistance to passive movement of the limbs on that side, leaned toward the right, and showed no impairment in muscular strength or sensory state. All, except 2345, showed slight and transitory cerebellar symptoms (Orioli and Mettler, 1956). It is of significance that this animal's deviation was of a clonic type (see accompanying text).

ANESUS	HEAD TURN		ENLARGEMENT OF THE MOUTH		FALLS TO		CLONIC CONTRACTIONS		PROPRIO-CEPTIVE REFLEXES		PLANTAR RESPONSE		PALMAR RESPONSE		INTER-OLIVE RESPONSE		INTER-OLIVE RESPONSE		TOTAL SPINAL CORD COMPLETION	
	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R
2354	0	0	0	0	0	0	0	0	N	N	N	N	N	N	N	N	N	27	27	20
2359	0	0	0	0	0	0	0	0	N	N	N	N	N	N	N	N	N	27	27	20
2360	0	0	0	0	0	0	0	0	N	N	N	N	N	N	N	N	N	17	17	
2396	0	0	0	0	0	0	0	0	N	N	N	N	N	N	N	N	N	19	19	
2479	0	0	0	0	0	0	0	0	N	N	N	N	N	N	N	N	N	20	20	36
2481	0	0	0	0	0	0	0	0	N	N	N	N	N	N	N	N	N	20	20	29
2588	0	0	0	0	0	0	0	0	N	N	N	N	N	N	N	N	N	24	24	34

Fig. 4.—Basic data on Cases 2479 and 2588 (fulguration of both descending limbs of the brachium conjunctivum and right rubrospinal tract), Case 2481 (fulguration of the right descending limb of the brachium conjunctivum and right rubrospinal tract), Cases 2354, 2359, 2380, and 2396 (interruption of the descending limb alone—2354, left; 2380, 2396, 2359, both sides). Cases 2359 and 2588 showed suprapontine damage of the medial longitudinal fasciculi (Case 2359, medial third of both medial longitudinal fasciculi; Case 2588, of all left and part of right medial longitudinal fasciculus). All these cases showed slight, transitory cerebellar symptoms; none showed impairment in muscular strength, in sensation, or of the palmar response.

site in sign and clonic adds substance to such an assumption. There was no damage of the medial longitudinal fasciculus in these cases.

One may speculate on the possibility that the descending limb of the brachium may exercise a determining influence in cases of rubrospinal damage at higher levels. Consequently, in two other monkeys (2479 and 2588), the right rubrospinal tract was fulgurated after both descending limbs of the brachium conjunctivum had been interrupted (Fig. 4). In the last of these two animals deviation of the head (chin) was toward the left; in the other no deviation was seen. When, in one case (2481) the right descending limb of the brachium conjunctivum was fulgurated, together with the right rubrospinal tract, there was, again, no cephalic deviation. As might be expected, interruption of the descending limb of the brachium conjunctivum, by itself (2354, left only; 2359, 2380 and 2396, bilaterally), failed to produce conclusive evidence that this bundle plays an important role in head-turning. Cephalic deviation was seen in one of these

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animals (2359) only. Thus head-turning was encountered in only two of these cases (2359 and 2588), and both of these animals suffered some damage of medial longitudinal fasciculus bilaterally. The direction of the deviation is shown in Figure 4, but no conclusion can be reached with regard to this as yet because of the bilaterality of the injury.

Lesions of the Medial Longitudinal Fasciculi

Carrea and Mettler (1955) encountered deviation of the head in only some of those animals in which the fibers of the brachium conjunctivum itself had been interrupted. Of 21 animals so operated on, 14 exhibited deviation and/or flexion of the head (see their Table 2). In 12 of these the medial longitudinal fasciculus had been infringed upon, and in 2 this bundle was sound. However, in only 3 of the 21 cases was there no damage in the medial longitudinal fasciculus. Thus, six cases with damage of that bundle showed no cephalic deviation, and two cases which did show it had no such damage. That the brachium conjunctivum itself can be cut without producing cephalic deviation was again seen in three of Orioli and Mettler's animals (2423, 2429, and 2435), which showed no notable turning of the head after severance of that bundle. When the right vestibular nuclear complex was later damaged in 2429 and 2435, and another animal was prepared in which the right brachium conjunctivum and right vestibular nuclear complex were simultaneously destroyed, all these animals developed marked deviation of the head (chin) to the left. In Case 2423 both vestibular nerves were cut after brachial section. This animal showed, somewhat unexpectedly, a deviation of the head (chin) to the right, for the rule which obtains with regard to supravestibular lesions is that the head (chin) is turned toward the side of the lesion and flexed toward the sound side, unless one has actually invaded the

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CASE	LESION		HEAD DEVIATION L R	COMPENSATION (DAYS)
	MLF LEFT	MLF RIGHT		
2481	PARTIAL		0	
2429		PARTIAL	↶	NONE IN 20
2528		COMPLETE	↶	NONE IN 16
2603	COMPLETE	COMPLETE	0	
2359	PARTIAL	PARTIAL	↷	FULL IN 12
2588	COMPLETE	PARTIAL	↶	NONE IN 34
2502	COMPLETE	PARTIAL	0	
2524	PARTIAL	PARTIAL	0	

Fig. 5.—Lesions of medial longitudinal fasciculus related with presence or absence of cephalic deviation and direction of this. Case 2429 also had a lesion of the right vestibular nuclear complex. In Case 2359 some damage of the left brachium conjunctivum existed also.

vestibular nuclear complex, whereupon the direction of deviation is opposite in sign.

It has already been noted above, in connection with Carrea and Mettler's (1955) animals, that cephalic deviation may or may not be accompanied by damage of the supravestibular part of the medial longitudinal fasciculi, and that such damage may or may not result in cephalic deviation. However, when the two phenomena are associated, they bear a constant relation to each other in accordance with the rule already noted, i. e., deviation of the head (chin) is toward the side of the lesion when only one is present.

Lesions of the medial longitudinal fasciculus were present in eight monkeys prepared in connection with the present study (Fig. 5). In three of these the damage was unilateral and in the remaining

cases bilateral. In three of these last five cases the damage was the same on both sides. In one (2502) the left fasciculus was more directly damaged, but the same degree of secondary degeneration was seen in both medial longitudinal fasciculi.

Among these eight animals deviation of the head was again seen in only four. In three it was very marked, the chin being deviated to the side of the lesion or (in two cases of bilateral damage, 2359 and 2588) to the side on which the medial longitudinal fasciculus was more extensively affected, regardless of the fact that in some of these cases the lesions were infravestibular. In Monkey 2429 the head was deviated to the opposite side. It will be recalled (see above) that this animal had a lesion of the right vestibular nuclear complex. One case (2481) with partial damage of one medial longitudinal fasciculus did not show any cephalic deviation, and neither did one with an unequal degree of bilateral damage. It will be observed that no deviation of head was seen when the fasciculi of both sides were affected in the same degree, even though they were totally destroyed (Fig. 4) and lateral gaze was bilaterally abolished. The exception was Case 2359, which showed only a mild and transitory deviation of the head, due perhaps to concomitant damage of the decussation of the brachium conjunctivum, particularly on the left side. Although deviation may not follow section of that bundle alone, damage to it seems to have a provocative effect in the presence of other lesions.

We have observed (Fig. 2) that Ferraro and Barrera (1936) have reported deviation of the chin toward the sound side in cases in which the intramedullary juxtarestiform body has been damaged, and toward the injured side when the supramedullary juxtarestiform body is cut alone or in association with the restiform body. It is not difficult to perceive that interruption of vestibulo-cerebellar fibers would have the same effect as eighth-nerve section, and we have found that deviation of the head (chin) occurs toward the sound side when the flocculus

has been injured in cutting the restiform body (Case 2499) or after section of the brachium pontis (Case 2546) with associated damage of the cerebellovestibular fibers. Section of the restiform body alone and by itself results in no deviation, as has already been mentioned, but large lesions in this vicinity may produce deviation of the chin toward the side of the lesion (Case 2532). Nodular or uvular lesions produce a deviation in the opposite direction (Fig. 2).

Spasmodic Cephalic Deviation of the Head

In sharp contrast to tonic torticollis or positions of sustained deviation of the head are those more or less rapid, phasic deviations which are interrupted by periods of normal postures. These movements may be fast and loose (tics), or slow, powerful, and of relatively prolonged duration (dystonic contractions). Movements of these types are great rarities in the experimental laboratory, and even though the inferior olive is specifically attacked, they and palatal myoclonus have continued to remain so. The most interesting case of this type which has occurred in our laboratory in the past 15 years is that of Cebus 91 (Orioli and Mettler, 1956, p. 308), motion pictures of which have been incorporated in various presentations by both Dr. Ernst Herz and Dr. John Whittier.

This beast suffered from a gliosis extending along the intramedullary course of the left eighth nerve, which gliosis followed section of the nerve. The animal's head was tilted so that its right ear approximated the right shoulder, and it showed quick, spasmodic right lateral jerks, which sent the chin toward the side of the lesion. Horizontal nystagmus, with the fast component also to the right, was commonly seen. It will be recognized that the direction of this animal's movements was to the side opposite that which would be anticipated on the basis of a vestibular nerve or nucleus lesion. In a recent study of the rubrospinal tract, rapid, clonic, involuntary contractions

were encountered in the trunk in Case 2337, in the trunk and limbs of Case 2340, and of the head and chin in Case 2345 (Orioli and Mettler, 1956). In the latter case the fast component of the movement was to the side of the lesion.

How are we to explain such tic-like movements? It is customary to assume that they are due to "irritation," which is a stimulating state, and therefore productive of effects which are the opposite of those due to defects. We can, however, envision another explanation. From what has been said above, it is apparent that all lesions cephalad of the vestibular nuclear complex tend to produce turning of the head (chin) toward the side of the lesion, whereas those in the position of that complex or peripheral to it result in deviation which is the opposite in sign. Lesions caudad to the vestibular nuclear complex produce deviation to either side. If they are of the lateral vestibulospinal tract, the chin moves toward the side of the lesion; otherwise, the reverse direction is assumed. There are thus two locations, beginning with the level of the vestibular nuclear complex, at which a shift in the direction of deviation can occur, and this circumstance can be utilized in attempting to explain the alternating nature of tics and spasmodic torticollis by advancing the hypothesis that in circumstances in which the balance between systems of opposite sign is disturbed, alternating movements may sometimes represent periodic reflex corrections of such imbalance. No doubt a gradual floating of the head in an abnormal direction might stretch antagonistic muscles sufficiently to produce adjustment through the myotactic reflex mechanism. Further, there is an equal possibility that such movements, when of a slower type, may be reflexly initiated through the vestibular apparatus.

Slow, forceful, dystonic, rather prolonged, but still unsustained contractions have never been seen in the laboratory as a result of infratentorial lesions, but movements like these, though of a looser nature, are rarely encountered after lesions in the vicinity of

the subthalamic nucleus. Such forceful, prolonged contractions cannot be explained upon the hypothesis of simple segmental reflex corrections of postural imbalance, as stated above, though it is not impossible that they may be suprasegmental extrapyramidal corrections. Neither does such a hypothesis explain why, in some cases of rapid, alternating movement, the direction of the fast component of the movement may change without apparent alteration in the resting position of the head. Finally, it does not seem to explain the very forceful, almost reverberating quality (tight, elastic decrement curve contractions) of some of these movements. Such a characteristic bespeaks a cerebellar component in the underlying physiologic cause, but precisely how such a component can become operative is not clear.

In addition to the possibilities that alternating movements of cephalic deviation are (1) essentially corrections of postural or vestibular imbalance or, in other cases, (2) part of the extrapyramidal abnormal movement complex (and thus akin to dystonia, athetosis, and ballism), the explanation has been advanced that such movements are (3) the result of irritative foci. It must be admitted that in the case of cephalic deviations there is good reason for consideration of the irritative hypothesis. In Case 91 the direction of the fast head twitch was opposite in sign to the direction in which deviation would have occurred had a simple destructive lesion existed. It is possible that the gliosis which constituted the obvious medullary lesion may have served as an irritative focus. In view of the chronicity of these disorders, such a hypothesis is not attractive but cannot be discarded, and is doubtless valid for some cases. To this group undoubtedly belong such twitches which are part of the syndrome of myoclonus epilepsy and atherosclerotic cerebrovascular disease.

The anatomical diagnostic problem which arises, then, in connection with alternating deviations of the head, is quite different

from that which presents itself when the deviation is of a maintained nature, since the location of the lesion is more appropriately estimated on the basis of the nature of the disease process than by a primary search for a focus, for which we secondarily seek a cause.

In general, alternating movements of a tic-like nature, with the exception of those caused by arteriosclerotic changes, are seen at earlier ages than those of the dystonic type and are encountered in a greater number and variation of clinical states. They are, moreover, not usually progressive in type. In such cases, where no other evidence of neurologic abnormality exists, especially when no evidence of heredodegenerative changes can be found, the cause of the condition may be sought in simple and benign imbalance in the dynamics of cephalic support. Such imbalance can be brought about by small, focal lesions in the neuraxis but may also derive from skeletal or muscular causes. When the tic-like movement has great force, a small amplitude and a distinct reverberating quality, an irritative focus, perhaps a gliosis in the vicinity of the central vestibular apparatus, may be suspected. If the direction of the fast movement is inconstant, in movements of this type, heredodegenerative disorders or congenital malformations often can ultimately be discovered. In such cases the pathology of the disorder is not clearly lateralized, and, in any event, it is a precarious practice to attempt to fix upon the laterality of the pathologic changes of any tic-like cases. The rule which may be applied, with some reservation, is that the direction of the fast movement is toward the sound side of the neuraxis except in instances where the afferent fibers of the vestibular nerve are directly involved in an irritative lesion. In other words, the direction of the chin during the fast movement is opposite to what is encountered in cases of maintained deviations.

Dystonic types of cephalic deviation are, on the other hand, and as is very well known (Gowers, 1895), frequent precursors of a

more obvious and complete picture of basal ganglia "disease." The mechanism of the production of the condition, when so caused, may be variable and founded upon either a genuine directional hyperkinesia, or it may be part of a picture of generalized, but unbalanced, muscular rigidity. Verbiest's (1949) experience in sectioning the first three cervical nerves (both rami) of both sides in cases of the latter type indicates that the postencephalitic difficulty in opening and closing the mouth may be similarly due to rigidity of the geniohyoid muscle and infrahyoid group.

In view of what we now know about the incidence of acute encephalitis, there is no doubt that the postencephalitic state is diagnosed more frequently than can be correct and a fairly specific history of infection should be accessible if the diagnosis is to have much meaning. If the history is vague with regard to infection, a history of personality disturbance in childhood is quite helpful, as is evidence of reversal of sedative-analeptic pharmacodynamics, and such cases are often erected upon a postencephalitic behavior syndrome of irresponsibility, impulsive, rash acts, destructiveness, and autonomic disturbances referable to hypothalamic involvement. If antecedent encephalitis cannot be detected, some other cause of so-called "basal ganglia" disease must be sought—such as hemorrhage, multiple sclerosis, or one of the degenerative syndromes, such as the "diencephalosis" of Kato, Hatotani, and Fukushima (1954).

Stutte (1947), speaking of "*striäten Schiefhals*," found "other" signs of what he called extrapyramidal disease in 26 of 31 patients with spasmodic torticollis. A difficulty with Stutte's interpretation, and an explanation of an associative frequency of over 80%, exists in that Stutte seems to consider all "extrapyramidal" disorders of "striatal" origin. Thus, his finding that spasmodic torticollis is most frequently associated with tremor, especially head tremor, can scarcely be used as an argument for its striatal origin, though the

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emphasis upon the frequency of concurrence of the two signs is valuable (13 of his 31 cases). In three cases, spasmodic torticollis was associated with dystonia. Other associations were with athetosis, chorea, and tic. Stutte encountered one case with a decided unilateral familial history, which included parkinsonism, familial tremor, and spasmodic torticollis in different individuals of that line. The appearance of spasmodic torticollis in individuals in families with neurologic equivalents, and even psychotic disorders, has long been noticed by many writers (Gowers, 1895). Wohlfart and Norlén (1946) have described such a lineage.

Because of the frequency of a provocative genetic background, it is of importance to search for congenital defects, particularly those of a combined type, in which both osseous and neural aberrations should be apparent. Stevens (1948) has described facial hemiatrophy, cervicothoracic scoliosis, congenital torticollis, extraocular palsy, and subnormal vision in twins, and many other patterns of combinations have been reported. One is struck by the frequency with which torticollis appears as part of the symptomatology in heredodegenerative disorders of the neural system. Van Bogaert (1948) has pointed out that spasmodic torticollis can appear as a purely degenerative entity, and, in view of the fact that interference with a great variety of mechanisms can produce it, this is scarcely surprising. Van Bogaert analyzed a family in which focal disorder of the neuraxis (Wilson's disease) was seen in some members and diffuse degenerations with torticollis in others. In view of the metabolic abnormalities now being elucidated in Wilson's disease, one is perhaps justified in assuming that the cause is a common one, manifesting itself variably because of the presence of different precipitating or inhibitory ancillary factors in different individuals.

During the middle of the last century it was the custom to consider many cases of torticollis to be of purely psychogenic origin,

but one hears less of such cases nowadays, and one even finds cases diagnosed as *torticollis spastico psicogeno su base organica* (Cristini and Ruosi, 1949). Herz and Glaser (1949) found a personality pattern characterized by emotional instability and maladjustment in about half of their 25 cases of "spastic" torticollis, which is presumably of no positive statistical significance. Herz and Glaser conclude that the phenomenon is always organically based but that psychogenic factors probably influence the resultant clinical picture.

Comment

Deviation of the head may occur as a tonic or phasic phenomenon. The diagnostic significance of these two types of deviation, when founded upon demonstrable neuropathologic change, is usually different. Tonic, postural alterations are generally due to specific, circumscribed lesions, whereas phasic turning is commonly the result of widespread, and often degenerative, changes. Where tonic deviation does exist, this may be of a mild or an insistent nature. The latter type is seen in musculoskeletal and posterior fossa involvement. Just what the localizing significance of tonic deviation may be when due to posterior fossa disease is not immediately apparent from the literature. Kemberling, Baird, and Spiegel (1952) begin with the assumption that the rotation of the head is of such a nature that the chin is toward the sound side and point out that this is the position produced by labyrinthine lesions. These authors produced cephalic deviation by hindbrain lesions and came to the conclusion that lesions of the vestibular nuclei do not always produce such a postural change and, since lesions in the "reticulate" substance may produce cephalic deviation, that this substance plays a role in such conditions. The full data on which Kemberling, Baird, and Spiegel's conclusions are based are not presented, so it is impossible to determine what proportion of their "reticulate" substance lesions infringed upon projections of the vestibular system,

but it is apparent from their photomicrographs that such involvement was present in some of their cases. Apparently the direction of the cephalic deviation varied in their material, since it is said that "most frequently the head is rotated . . . toward the side of the lesion." One is thus left with the impression that deviation in either direction can result from lesions which do or do not involve the vestibular system. That matters are somewhat more predictable and orderly than this we have been led to expect from the clinical dictum expressed by Brain (1951) as the "cerebellar" posture which, as he says, is the same as that "due to an interruption of afferent impulses derived from the otolith organs." Brain has pointed out that the direction of deviation may be different in the early stages of a

tumor than in the later stages and that this shift is due to a variation in the structures which are rendered dysfunctional. This circumstance is not, of course, an inevitable one in cerebellar tumors, and the initial direction of deviation will vary according to whether the vestibular or nonvestibular pathways have been functionally impaired.

We may agree with Kemberling, Baird, and Spiegel's conclusion that deviation of the head does not always follow lesions of the vestibular apparatus and may occur as a result of a rhombencephalic lesion outside the vestibular nucleus. We may go further and add that not only do provocative lesions not need to involve the projections of the vestibular nuclei but they do not have to be situated in the reticular formation, for the phenomenon can be seen after supra-

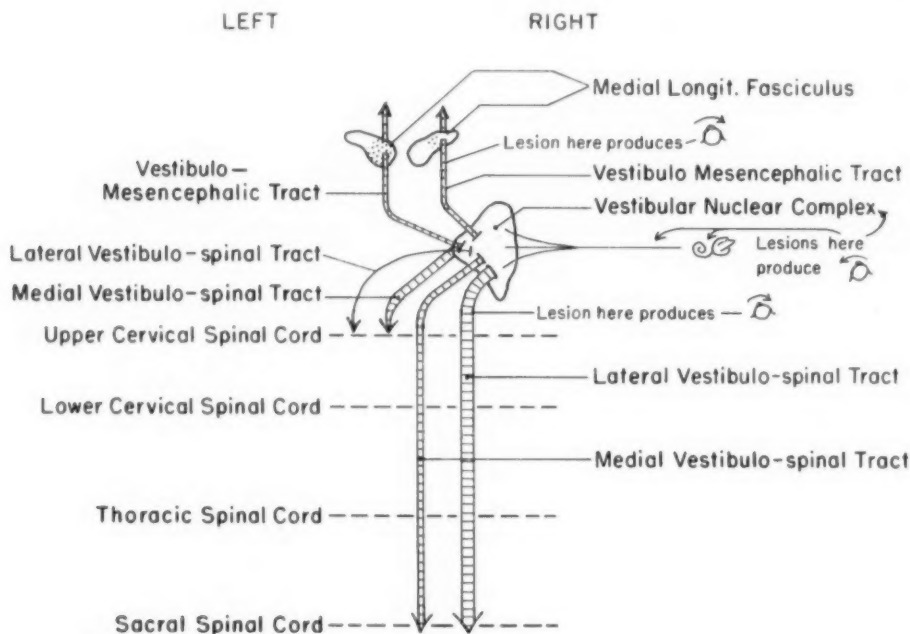


Fig. 6.—Diagram of the projections of the vestibular system, as these are seen in primates, and the direction of cephalic deviations produced by interference with various parts of this. Most of the long descending projections of the vestibular system are homolateral in primates. The most pronounced contribution is in the form of uncrossed fibers to the lateral vestibulospinal tract, and the next most pronounced consists of such fibers to the medial vestibulospinal. A larger number of fibers pass across the midline into the opposite medial vestibulospinal tract, but these cannot be traced below the upper cervical spinal cord. Only a few crossed fibers enter the lateral vestibulospinal tract (Mettler, 1944). The vestibulomesencephalic tracts are only medial, of course, and contain about the same number of crossed and uncrossed fibers.

pontine or infrapontine rubrospinal lesions. In the latter event (Cases 2337, 2349, 2358) the chin is directed away from the lesion side and the deviation is thus opposite in sign to what would be encountered if the lateral vestibulospinal tract had been involved. Since lesions of the suprapontine brain stem, and thus of the rubrospinal tract, produce deviation toward the side of the lesion, we must assume that the rhombencephalic rubrospinal tract is not itself the responsible element in deviation toward the sound side. Very probably the cause is to be sought in damage of the afferent elements of the vestibular system, either in the flocculus or as a result of interference with their blood supply, and we are provided with an example of circumstances which call for a high degree of caution in their evaluation.

Examination of Figure 6, which shows that cephalic deviation is toward the side of the lesion when the medial longitudinal fasciculus is involved above the vestibular nuclear complex (and thus opposite in sign to that following damage of the vestibular nerve-nuclear complex), or when the lateral vestibulospinal tract is involved below it, may bemuse the reader who is trying to explain cephalic deviation in terms of involvement of a single descending pathway, such as the interstitiospinal. It should be apparent from what has been said above that we do not feel that abnormalities in head-turning can be attributed to interference with any one system, and we have therefore not drawn this figure in such a way as to attribute lateral deviation of the head quite simply to interruption of the interstitiospinal tract of the same side (chin to the side of injury). While this classical view, recently espoused by Hassler and Hess (1954), like the opinions of Magnus and of Rademaker, is in accordance with a large part of the observed evidence, it does not satisfactorily encompass all of it. Doubtless interruption of the location of the interstitiospinal tract does often produce deviation toward the same side, and Hassler and Hess have demonstrated that stimula-

tion of the vicinity of the nucleus interstitialis produces a downward turning of the ear on that side and approximation of it toward that shoulder (i. e., a result much like that which would succeed a labyrinthine lesion of that side). Although the coincidence of the medial longitudinal fasciculus and interstitiospinal tract is imperfect, what has been said in this study about the former is evidently equally applicable to the latter. It may be possible to explain those cases in which damage of the medial longitudinal fasciculus did not cause deviation by assuming that the interstitiospinal fibers escaped damage, but this still leaves us with the difficulty of actual deviations in which no interstitiospinal damage could have occurred or, in the case of stimulation experiments, why stimulation of other loci produces head-turning. Hassler and Hess get around this difficulty by asserting that the interstitiospinal tract is coordinated with mechanisms in the internal capsule and subthalamus and is directly activated by the vestibular, and indirectly by the cerebellar, mechanisms. This may be granted as possible, but there are other possibilities, the existence of which relieves us of the necessity of accepting the hypothesis that the interstitiospinal is necessarily the efferent mechanism of head-turning.

We may bring the results of the present investigation together as follows: Destruction of one labyrinth produces a deviation of the head in which the chin is directed toward the sound side (Northington and Barrera, 1934). When the vestibular nerve is destroyed, the same result is produced. If both vestibular nerves are sectioned, no deviation occurs.

Destruction of the vestibular nuclei of one side produces deviation of the head (chin) toward the sound side (Ferraro, Pacella, and Barrera, 1940; Orioli and Mettler, 1958, Cases 2429, 2435, 2483). When both vestibular nuclei are damaged, no deviation may occur or deviation in either direction may be observed (idem 2423).

Destruction of the lateral vestibulospinal tract below the level of the vestibular nuclei produces deviation toward the affected side.

Lesions of one medial longitudinal fasciculus above the level of the vestibular complex produce deviation of the chin to the affected side (2528, 2588, Fig. 4) or are unproductive. If the fasciculi of both sides are involved, the deviation may be in either direction (2359, Fig. 4) or no deviation may appear.

Lesions of the flocculus produce phenomena like those which follow vestibular lesions. Lesions of the non-vestibular cerebellum are not ordinarily productive of deviation of the head. Lesions of the nodulus or uvula produce deviation opposite in sign to the consequences of lesion of the vestibular nerve. Lesions of one side of the pons or mesencephalon produce deviation of the head to the side of the lesion (Mettler, 1944; Carrea and Mettler, 1955), regardless of whether the decussation of the brachium conjunctivum is severed prior or subsequent to its decussation, the direction of deviation apparently depending upon damage of the medial longitudinal fasciculus.

Supratentorial lesions result in deviation of the head to the side of the lesion.

Some cases of clonic cephalic deviation are explicable upon the hypothesis (discussed in the text) that the responsible lesion lies in loci which result in an unstable condition of the cervical muscles, in which "floating" toward one side is periodically offset by reflex contractions of a corrective nature.

Conclusions

In maintained deviation of the head due to neurologic lesions, the abnormal posture may be due to involvement of a wide variety of structures. When the lesion is above the level of the vestibular nuclear complex, there is little to be gained by attempting to identify the responsible structure. The practical rules which may be followed are that the direction of deviation of the head (chin) is toward the side of the lesion in all cases

except those which involve the labyrinth or fibers of the vestibular nerve up to and including their endings in the vestibular nuclear complex and flocculus. In such cases the direction of deviation is opposite in sign. In general, the more constantly the posture is maintained, the more severe the torticollis, and the less the degree of compensation, the closer to the labyrinth the lesion may be expected to lie. In infratentorial lesions presenting sustained cephalic deviation, the medial longitudinal fasciculus may or may not be damaged, and it may be damaged in cases which do not exhibit deviation. In cases where both medial longitudinal fasciculi are unequally damaged the deviation is toward the side of more extensive damage.

When the lesion lies below the level of the vestibular nuclear complex, deviation to either side may be seen. Usually it is to the side of the lesion. Rubrospinal damage at such levels is sometimes accompanied by deviation to the sound side. It is possible that in such instances indirect damage of the vestibular nuclear complex exists.

Clonic or phasic torticollis is rarely the result of a discrete lesion. When it is, its fast component is likely to be opposite in sign to what would be expected to follow a lesion, and the lesion may be thought of as irritative, particularly when, as sometimes is the case, it turns out to be a gliotic area. The clonic movements produced by such lesions are rapid, poorly sustained, and tic-like, and the foci which have been found to cause them in the laboratory are usually in the vicinity of entrance of the vestibular nerve. Since the direction of maintained deviation shifts sides in this region, it has been found useful to look upon some cases of spasmodic torticolles as exhibiting tonic or reflex contractions activated by an interference with the mechanism responsible for tonic maintenance of cephalic posture. Powerful, slow, writhing torticollis has not been produced in the laboratory. There is no reason to suppose it is other than a

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manifestation of dystonia, or that it has its origin in a separate neuropathologic state.

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Studies of the Hypoglycemic Brain

Amino Acids, Nucleic Acids, Total Nitrogen, and Side-Group Ionization of Proteins in Cat Brain During Insulin Coma

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A deficiency of glucose supply to the brain is followed by a gradual reduction in carbohydrate reserves, a decrease in oxygen uptake,^{1,2} and a reduction in the high-energy phosphates of that organ.¹ In this situation, the compounds which are considered to be the usual free-energy sources have been depleted, and the question becomes: "What are the chemical consequences of this state?"

The evidence presented indicates that deep hypoglycemia in the cat or rat does not result in any appreciable change in the quantity of cerebral deoxyribonucleic acid (DNA) or pentose nucleic acid (PNA). However, it does produce alterations in the pattern of the free amino acids, and during profound hypoglycemia a decline in practically all of the amino acids. The total nitrogen and acid-soluble nitrogen content remain practically the same; and the side-group ionization of the proteins is not significantly altered.

Method

Twelve adult cats were made hypoglycemic by the following procedure: After a 24-hour fast, the cats received 5 units of protamine zinc insulin injection U. S. P. intramuscularly. Approximately 15 hours later the cats were severely hypoglycemic and in most instances had had hypoglycemic seizures. Then a routine of hourly crystalline insulin injections of 1.0 cc. (40 units per cubic centimeter) was begun. Each cat was injected with sufficient pentobarbital sodium to prevent convulsive movements, especially during the early stages of

hypoglycemia. The electroencephalographic (EEG) changes in the right motor and left limbic leads were observed with monopolar and bipolar recordings. Electrocardiographic (ECG) tracings were made at 15-minute intervals to monitor cardiac activity during the hypoglycemia, and artificial respiration was used to prevent hypoxia. When the ECG indicated that cardiac function was beginning to fail, which was usually after four to eight hours of severe hypoglycemia, a craniotomy was performed and the brain excised at the midcollicular level. The excised brain was then divided bilaterally and each half cut into three pieces and dropped into a mixture of ether-carbon dioxide snow (Dry Ice). The entire operation, from removal of the brain to freezing, took one to two minutes. The frozen pieces were wrapped in aluminum foil and kept at -17°C until used for analysis. All determinations were done on mixed samples of an entire cerebral half. Seven non-hypoglycemic cats were similarly treated and used as controls.

For the nucleic acids in rat brain, 24 female rats of a Sprague-Dawley strain fasted 24 hours, were used. Twelve rats were given 120 units per kilogram of regular insulin (40 units per cubic centimeter) intraperitoneally; then another 120 units per kilogram was given one hour later. Three to four hours after the injection, all the rats had gone through a period of severe convulsive seizures and had lost their righting reflexes. They were decapitated, and their brains were quickly removed and dropped into a carbon dioxide snow-acetone freezing mixture. The procedure from decapitation to freezing took one to two minutes. The brains from two rats were pooled for the chemical analysis. The frozen brains were transected so as to exclude the cerebellum and medulla oblongata, quickly weighed, and homogenized in cold NaCl (0.85%) solution to make a 10% homogenate. Four determinations were carried out on each homogenate. The remaining 12 rats were treated in the same manner except that no insulin was given, and these rats served as controls.

Nucleic Acids.—The nucleic acids were determined by the characteristic ultraviolet absorption

Submitted for publication June 26, 1958.

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of the purine and pyrimidine bases. The procedure used was essentially that described by Logan, Mannell, and Rossiter.⁸ This method avoids the large error introduced by "inositide phosphorus" inherent in some methods if they are applied to nervous tissue.

Total and Acid-Soluble Nitrogen.—The total and trichloroacetic-acid-(10%)-soluble nitrogen was determined by a macro-Kjeldahl procedure. The analyses were carried out on ground-up frozen cerebral halves, including the structures on one side from the cortex to the midcollicular level.

The amino acids were determined by two-dimensional chromatography in an 80% phenol and butanol-acetic acid-water (4:1:1) system. The method was essentially that of Awapara,⁴ for the free aspartic, glutamic, and γ -amino butyric acids; serine; aminoacetic acid (glycine); glutamine; threonine; alanine, and valine. The tissue samples were extracted with homogenization in 95% ethanol, filtered, and washed with 80% ethanol. The ethanol extract was treated with chloroform to remove the lipids. The sample was evaporated to dryness and redissolved in 0.1 ml. 10% isopropanol per gram of original tissue weight. A total of 18 μ l of this solution was applied to Whatman No. 1 papers. The chromatograms were run at $30 \pm 1^\circ \text{C}$. After the migration, the papers were sprayed with ninhydrin (0.05% in dry butanol) and allowed to dry. After a short period in the dark the amino acids could easily be identified as distinct blue spots. The spots were eluted with 75% acetone and the amount of

amino acid determined by the method of Naftalin.⁶ This is essentially a ninhydrin color reaction for the amino acids. The color intensity was determined spectrophotometrically at 575 $m\mu$.

Standards were prepared by dissolving weighed amounts of amino acids in 10% isopropanol (5 mg. amino acid per cubic centimeter). From 2 μ l to 30 μ l of sample was applied to the paper and run in the same manner as the experimental samples. A standard was run for each of the amino acids determined, and the standards were recovered in a linear relationship to the amounts added.

Protein-Side-Group Ionization.—The analysis of the side-group ionization of proteins was carried out using the method of Ungar et al.⁹ Weighed amounts of frozen brain were homogenized in cold 0.85% NaCl to make a final concentration of 10%. The homogenate was incubated 20 minutes at 37.5°C with constant shaking, and was then centrifuged at $24,000 \times g$ for 30 minutes in a refrigerated centrifuge at 0°C . An aliquot of the supernatant was diluted in saline and another in 0.5 N KOH. The optical density of the solutions in the regions of 245 $m\mu$ and 295 $m\mu$ was measured. The final solution corresponded to 10 mg. of fresh tissue per cubic centimeter. The optical density at pH13 minus the optical density of pH7 was considered a measure of the protein-side-group ionization.^{9,7}

Results

The progressive changes observed in the EEG during hypoglycemia are presented

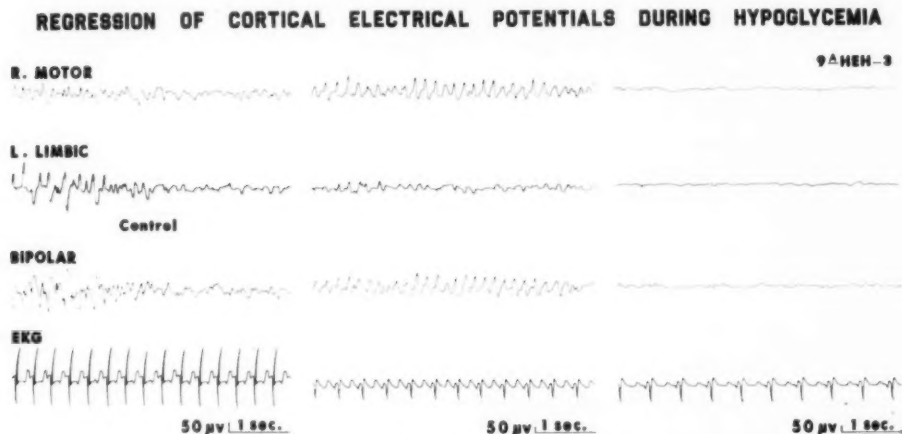


Fig. 1.—Three groups of cortical and cardiac tracings: before the administration of insulin, during mild insulin hypoglycemia, and, finally, with deepest hypoglycemia. In all three groups, the first tracing is taken from a monopolar electrode placed on the right motor cortex; the second, from a monopolar electrode on the left limbic cortex; the third is bipolar. The fourth tracing refers to the heart. The controls form the first group of tracings with a cat under light barbiturate anesthesia. They reveal light sleep followed by awakening. The second group shows the effect of early hypoglycemia with some slow waves of increased amplitude, especially in the motor cortex, and hence in the bipolar tracing as well. The third group discloses the results of deep hypoglycemia. Organized cortical waves have ceased, and the heart is slowed.

(Fig. 1). The first group of tracings shows the control electroencephalogram, with a period of light sleep followed by an alert period. The sleep waves are facilitated by the small amount of pentobarbital sodium injected. The middle group of tracings reveals the electroencephalogram taken from an animal in continuous hypoglycemia since the previous night. The slow waves of higher amplitude are characteristic of the earlier stages of hypoglycemia. In the last group of tracings the EEG associated with a profound state of hypoglycemia is seen. There is a progressive decrease in amplitude and frequency, and finally all undulations cease. The EEG waves completely disappeared in all but three cases before cardiac function began to fail, and in the three exceptions the EEG was altered considerably before the ECG indicated cardiac failure. The EEG remained flat for periods varying from a few minutes to 2 hours and 50 minutes before the brain samples were taken.

The data from several determinations of the nucleic acids on 20 cats are shown in Table 1. The mean values of deoxyribo-

TABLE 1.—Results of the Analysis of Cerebral Nucleic Acids from Eleven Cats in Continuous Hypoglycemia and from Eleven Control Cats With the Same Techniques But Without Insulin

Nucleic Acids						
Cat Brain Mg. P/100 Gm. Tissue						
DNA		PNA		PNA/DNA		
Control	Hypo- glycemic	Control	Hypo- glycemic	Control	Hypo- glycemic	
5.14	6.02	7.84	8.53	1.53	1.42	
6.49	6.00	8.29	8.30	1.28	1.38	
7.43	4.66	9.67	6.90	1.30	1.48	
—	5.91	—	8.59	—	1.45	
6.66	6.02	8.46	9.22	1.27	1.39	
5.66	5.60	9.48	8.72	1.67	1.56	
6.77	5.41	9.32	8.65	1.38	1.60	
6.90	6.50	9.75	8.33	1.41	1.28	
6.38	6.48	7.95	7.60	1.25	1.17	
6.06	7.24	8.39	8.17	1.38	1.13	
5.38	6.06	7.43	7.75	1.38	1.28	
6.81	—	8.02	—	1.18	—	
Mean 6.33	6.05	8.61	8.25	1.37	1.38	
S. D. 0.67	0.65	0.78	0.60	0.13	0.14	

TABLE 2.—Results of the Analysis of Cerebral Nucleic Acid from Twelve Hypoglycemic Rats and from Twelve Control Rats*

Nucleic Acids					
Rat Brain Mg. P/100 Gm. Frozen Brain					
DNA		PNA		PNA/DNA	
Control	Hypo- glycemic	Control	Hypo- glycemic	Control	Hypo- glycemic
10.01	8.72	13.36	14.32	1.33	1.64
8.48	8.75	12.88	13.13	1.52	1.50
9.09	8.84	13.74	13.71	1.51	1.55
9.44	7.93	15.78	12.75	1.67	1.61
7.69	8.16	13.89	13.12	1.81	1.61
9.79	7.05	16.36	14.27	1.67	2.02
Mean 9.08	8.24	14.34	13.55	1.58	1.66
S. D. 0.61	0.63	1.28	0.60	0.15	0.17

* Values represent the average of four determinations on a pooled sample from two rats (see text).

nucleic acid (DNA) and pentonucleic acid (PNA) are about 5% lower in the hypoglycemic cats, but these differences are not significant ($P>0.10$). It follows that the ratio of PNA/DNA is also essentially unchanged. The DNA and PNA contents of rat brains are given in Table 2. The findings are similar to those in the cat; that is, the deep hypoglycemia produced no

TABLE 3.—Results of the Analysis of Cerebral Nitrogen from Nine Cats in Continuous Hypoglycemia and from Six Control Cats With the Same Techniques But Without Insulin

Nitrogen			
Cat Brain			
Control		Hypoglycemic	
Total N, %	Acid Soluble N, %	Total N, %	Acid Soluble N, %
1.94	0.14	—	—
2.02	0.18	1.85	0.15
—	—	1.66	0.09
2.13	0.18	1.88	0.17
1.96	0.18	2.01	0.14
1.56	0.16	2.06	0.16
1.88	0.16	1.84	0.17
—	—	2.07	0.17
—	—	1.86	0.14
—	—	1.61	0.14
Mean 1.98	0.17	1.87	0.15
S. D. 0.08	0.02	0.14	0.02

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TABLE 4.—Results of the Determination of Cerebral Protein-Side-Group Ionization*

Cerebral Protein Side-Group Ionization O. D. pH13—O. D. pH7			
Hypoglycemic		Control	
245 m μ	295 m μ	245 m μ	295 m μ
0.690	0.151	0.603	0.137
0.906	0.179	0.564	0.115
0.808	0.195	0.608	0.147
0.565	0.142	0.561	0.120
0.473	0.117	—	—
0.497	0.116	0.476	0.113
0.444	0.116	0.635	0.149
0.458	0.112	0.423	0.106
0.497	0.116	—	—
Mean	0.593	0.553	0.127
S. D.	0.159	0.071	0.016

* See text for the procedure.

significant decrease in the mean values ($P>0.10$ for DNA; $P>0.10$ for PNA).

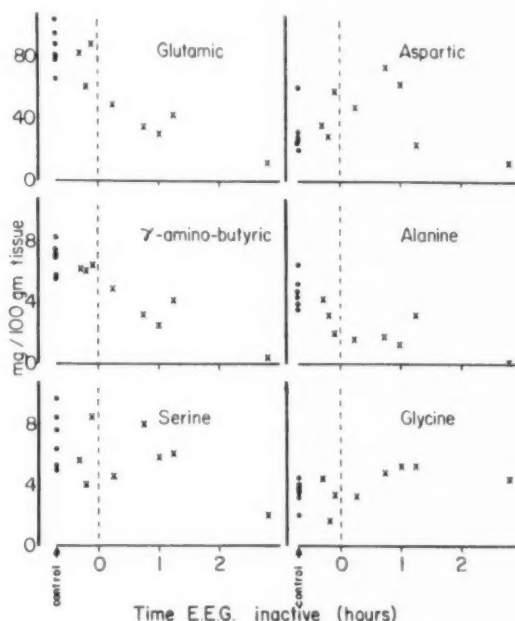
The observations of the total and trichloroacetic-acid-soluble nitrogen determinations (Table 3) show a decrease in the mean value of the total nitrogen of about 6%, but, again, this change is not significant ($P>0.10$). The data from the protein-

side-group ionization are found in Table 4. The concentrations of some of the free amino acids are presented in a series of graphs (Fig. 2) and are discussed below.

Comment

This paper presents the results of an exploration into the effects of hypoglycemia on brain nucleic acids, proteins, and amino acids. Except for changes in some of the amino acids, these cerebral constituents appear to be too stable on the whole to be influenced even by a state of hypoglycemia as severe as was used in these experiments. The very great heterogeneity of cerebral constituents not only from region to region but from organelle to organelle within cells has been emphasized by Waelsch.⁸ Generalizations from studies on highly active fractions, such as the microsomal proteins, to the entire class of proteins may not be valid. On the other hand, analyses of large sections of tissues, as was done here, have the limitation of not yielding any information about translocations of compounds or about small changes in limited regions.

Fig. 2.—Time relationship between changes in the EEG and the cerebral free amino acids during insulin hypoglycemia in the cat.



It is recognized that alterations in the polymerization of nucleic acids could occur without a change in the amounts of those compounds and, also, that a brain subjected to a still greater deprivation of energy might show a decrease in the cerebral nucleic acid content. However, our data indicate that a breakdown in the nucleic acids does not take place even during extended hypoglycemia.

The experiments of Abood and Geiger⁹ on cat brain perfused with a glucose-free blood substitute revealed that the nucleic acids in the microsomal and supernatant fractions of the cerebral cortex decrease. The decreases at the end of 50 minutes of perfusion are 46% and 32%, respectively. The mitochondrial nucleic acids remained essentially unchanged, and the nucleic acids of the nuclear fractions were not measured. In the two experiments reported, an average of 0.40 μ M of nucleic acid disappeared during 50 minutes of glucose-free perfusion. Approximately 0.12 μ M was lost in the control during the same period of time; thus a net loss of 0.28 μ M per gram attended the glucose-free perfusion. If the nucleic acid content of the whole tissue is 4.82 μ M per gram (as calculated from Table 1), the percentage change of the total is $\frac{0.28}{4.82} \times 100 = 5.7\%$. This change is very close to the percentage change in the mean with hypoglycemia shown in our Table 1.

In the case of the DNA it is not surprising that practically no change occurred with hypoglycemia, for DNA is generally found to be a metabolically stable material. Thus, atoms from intermediary metabolites are not introduced as readily into tissue DNA as into proteins and soluble cell constituents,¹⁰ and, further, it has been shown that the DNA content of the nucleus in liver does not vary with sex, strain, or body weight, and is not affected by fasting, protein-free diet, thiamine-deficient diet, high-fat diet, diabetogenic doses of alloxan, or by pregnancy.¹¹ As pointed out by Hotchkiss, the role of DNA as the carrier

of biological heritage requires a metabolic stability and minimal participation of DNA in the breaking down and rebuilding of cellular constituents.^{10,12,13} Our results, then, indicate that cerebral DNA is stable to hypoglycemia.

Protein Denaturation.—An aqueous extract of brain strongly absorbs ultraviolet light, and a considerable fraction of this is the light absorbed by the proteins extracted. A shift in the pH of the proteins will change the ionization of side-groups, while a rise in the pH of the brain extract results in the increase in the amount of light absorbed.^{7,14} Further, when proteins are denatured, these extinction coefficient changes with pH are greatly increased. This phenomenon has been interpreted to mean that denaturation is a breaking of hydrogen bonds and that certain phenolic (OH) groups involved in the hydrogen bonding are made free to ionize.^{7,14} Ungar has reported evidence that stimulation of nervous tissue produces a similar increase in the extinction coefficients and concludes that stimulation is associated with a reversible denaturation of the protein.⁶

Our experiments using essentially Ungar's procedure indicate that the mean "side-group ionization" of brain protein does not change in hypoglycemia (Table 4). However, the brain samples were frozen in relatively large pieces in these experiments and the freezing rate may not have been rapid enough. Parenthetically, we would like to add that we preferred to express the results as changes in the actual optical densities rather than as the ratio of the optical densities, as used by Ungar. The total ultraviolet light absorbed by a simple saline extraction of the brain is the sum of the light absorbed by the compounds extracted, and some of these are not proteins. The numerical value of the ratio of the light absorbed at the neutral and alkaline pH (i. e., O. D. pH13/O. D. pH7) is influenced by the contribution of the nonprotein factors. This actually represents the improper use of the pH7 sample as a blank.

In Table 4 the optical density of the tissue extract at pH13 minus the optical density at pH7 (O. D. pH13-O. D. pH7) is given for nine hypoglycemia cats and seven controls. The extent of the change at 295 $m\mu$ is a measure of the ionizable phenolic (OH) groups in the tyrosine moieties of the protein.¹⁴ It has been claimed that the change in the optical density at 256 $m\mu$ is a measure of the ionizable sulfhydryl groups.⁶ This is based on the large value of the (O. D. pH13-O. D. pH7) that cysteine displays at 245 $m\mu$. However, tyrosine also has a large value, and a more detailed examination of the point needs to be made. The data in Table 4 show a larger mean value of the "side-group ionization" in hypoglycemic cat brain than in the controls at both wavelengths. If this is a significant difference, it indicates some denaturation of the cerebral proteins in deep hypoglycemia. However, the variation in the individual values is large, and the difference is probably not real ($P>0.10$).

We have confirmed the data of the amino-acid changes during hypoglycemia of Dawson, Richter, and, particularly, of Cravioto et al.¹⁵ and have attempted to relate them to the EEG. The greatest decrease takes place in glutamic acid which falls to about half the control value, as previously reported by Himwich¹⁶; γ -amino-butyric acid, valine, glutamine, alanine, and serine all diminish. In contrast, the aspartic acid level becomes higher in hypoglycemia, as does that of aminoacetic acid, at least in early hypoglycemia. Later on aspartic acid, too, falls like the others. These changes indicate a transamination between glutamic and oxaloacetic acid to form γ -ketoglutaric and aspartic acid. This transamination has been shown to be one of the most rapid reactions of the brain¹⁷ and accounts for the increase in aspartic acid in hypoglycemia, especially if the aspartic acid is slowly utilized. However, the fall of glutamic acid is not all accounted for in the rise of aspartic acid.

In a general way, there is a correlation with the concentrations of the various amino acids and the cessation of electroencephalographic activity (Fig. 2). Glutamic acid is said to be capable of reactivating the dialyzed choline acetylase system.¹⁸ Also, glutamic acid will prevent the loss of K^+ from slices of brain cortex.¹⁹ Possibly, then, the disappearance of EEG undulations is a result of a decrease below a critical level not only of glucose but also of the brain amino acids, including glutamic. It is true that glutamic acid restored environmental contact in schizophrenic patients treated with insulin hypoglycemia.¹ However, in rabbits subjected to a more profound hypoglycemia for 18 to 23 hours, glutamic acid was not able to reestablish the EEG.²⁰

Because of the important relationships between the maintenance of function and the supply of energy, it is essential to determine the energy made available by the changes in the proteins, amino acids, and nucleic acids. It is well known that the proteins can be broken down into amino acids, and the amino acids, in turn, can enter the tricarboxylic-acid cycle reactions after deamination or transamination. However, the evidence given in Table 1 on the total and acid-soluble nitrogen in the hypoglycemia cat brain suggests that no major conversion of protein to carbohydrate materials has occurred. Dawson also found practically no change in the protein amino acid nitrogen of rat brain with hypoglycemia.²¹ So far as the free amino acids are concerned, the extent of their changes could yield only a very small part of the total energy requirement of the brain. Further, the free amino acids, except for glutamic, are not rapidly utilized by isolated cerebral tissue. Indeed, aspartic acid, serine, and alanine have no effect at all on the *in vitro* respiration of cerebral cortex.²² Thus, the amino acids not only are too small in quantity to be an appreciable source of free energy but are not oxidized fast enough to meet the rate of energy requirement. Owing to the general biological

stability of the nucleic acids, it is not anticipated that they would be oxidized rapidly enough, if at all, to be an appreciable source of energy. The evidence presented in this paper supports this view.

Conclusions

1. Severe insulin hypoglycemia does not lead to any appreciable change in the total deoxyribonucleic acid or the pentonucleic acid content of the brain.

2. The "protein-side-group ionization" of cerebral protein is unaltered.

3. The pattern of the cerebral free amino acids is altered in hypoglycemia. Glutamic acid is markedly decreased; γ -amino-butyric acid and alanine are also reduced, but to a less extent. Aspartic acid increases during the early stages but later decreases. Aminoacetic acid (glycine) is slightly increased.

4. There is a small tendency for the total nitrogen and acid-soluble nitrogen of the brain to decrease during hypoglycemia.

5. The energy that might be made available from the changes in the cerebral protein, free amino acids, and nucleic acids could supply only a negligible fraction of the total cerebral energy requirement of the brain in the hypoglycemic cat.

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HYPOGLYCEMIC BRAIN

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Abstracts from Current Literature

Diseases of the Spinal Cord

POLIOMYELITIC PARALYSIS OF DEGLUTITION—UPPER ESOPHAGEAL ACHALASIA. D. SCOTT, A. M. A. Arch. Int. Med. 101:655 (March) 1958.

Scott describes persistent aphagia occurring in a 5-year-old child with bulbar poliomyelitis. Despite the fact that otherwise complete recovery occurred fairly promptly, a dyssynchrony of deglutition persisted for over two years. This defect was characterized by a failure of esophageal "mouth" closure on an open glottis, producing risk of aspiration and necessity for tracheotomy, and a corresponding failure of "mouth" opening on a closed glottis, producing aphagia and necessity for gavage. The condition spontaneously subsided, and the author recommends an extended trial of conservative treatment in such situations before resorting to more radical measures, such as cricopharyngotomy, neurectomy, or myectomy. The defect was believed to be due to damage to the medullary deglutitional centers by poliomyelitis, in which case the spontaneous recovery some 27 months later is rather interesting.

PARSONS, MONTROSE, N. Y.

TABETIC OPTIC ATROPHY: FIFTEEN-YEAR FOLLOW-UP AFTER TREATMENT WITHOUT PROGRESSION. E. D. HELMICK, A. M. A. Arch. Ophth. 57:282 (Feb.) 1957.

In the past, tabetic optic atrophy has been notoriously resistant to treatment. Spontaneous arrest has occurred in an occasional case, and the atrophic process has remained stationary without antisyphilitic treatment. In most cases the degenerative process manifests itself by a typical visual field defect in one eye, with involvement of the second eye occurring sooner or later, unless checked by treatment.

The case which the author describes is of interest because the patient could be observed, over a period of 15 years, with no changes in the visual status, and because a very low total dose of penicillin apparently was successful in arresting the syphilitic process. The penicillin dose was 1,200,000 units, resulting in a normal cerebrospinal fluid. In spite of this low dosage, the patient's visual and neurologic condition remained stationary, and there have been no other manifestations of reactivation of the syphilitic process.

SPAETH, Philadelphia.

MENINGEAL DIVERTICULA OF SACRAL NERVE ROOTS (PERINEURIAL CYSTS). K. J. STRULLY, J. A. M. A. 161:1147 (July 21) 1956.

Four cases of meningeal cyst in the sacral region are reported in detail, supplementing a series previously reported. Low-back pain, unexplained by usual diagnostic procedures and resistant to ordinary treatment, led to the use of delayed myelography with iophendylate, which showed the existence of diverticula of the root sheaths of various sacral nerves. The x-ray evidence was confirmed at operation. Laminectomy revealed not only the cysts filled with contrast medium but also extensive cavitations in the bone. Opening the cysts and resecting the affected nerve roots was followed by great improvement in the patient's condition in each case. These cases show that cyst-like diverticula of the nerve sheath can develop in adult life, that they can cause local pressure atrophy in bone, and that they are amenable to treatment.

ALPERS, Philadelphia.

NEED FOR CONSIDERATION OF INTRASPINAL TUMORS AS A CASE OF PAIN AND DISABILITY. W. MCK. CRAIG, J. A. M. A. 163:436 (Feb. 9) 1957.

Craig reviewed the histories of a series of patients in whom intraspinal tumors were found at operation. The antecedent signs and symptoms were varied; they often led to mistaken diagnosis, ranging from syphilis to cholecystitis, and were treated by many different medical and surgical methods. The intraspinal tumor sometimes coexists with organic disease elsewhere in the body; occasionally it is a metastasis from a tumor of the breast or prostate.

The pain syndrome is present in 80% of the cases. The character of the pain is informative, since it persists in one area, extends over the same nerve roots, is usually lancinating in character, is aggravated by straining, and awakens the patient at night. Persistent pain should be suspected of being of central origin. Disabling neurological disorders that do not progress or present the usual clinical picture should be suspected of having intraspinal lesions as their cause. Repeated neurological examinations and examinations of the cerebrospinal fluid should

ABSTRACTS FROM CURRENT LITERATURE

be accompanied by studies with the use of a contrast medium of the subarachnoid space of the spinal column. Protruded disks can so simulate intraspinal tumors that a myelogram may be necessary to differentiate between them. Since the majority of these tumors are benign and operable, surgical removal is indicated; it is attended by a mortality rate of less than 4%.

ALPERS, Philadelphia.

CERVICAL DISK LESIONS. G. L. ODOM, W. FINNEY, and B. WOODHALL, *J. A. M. A.* 166:23 (Jan. 4) 1958.

It is the purpose of this paper to reassess and evaluate the progress made in the treatment of cervical disk pathology by reviewing the 246 cases in which surgically verified disk lesions were treated over a 16-year period, from 1940 to 1956. These lesions were divided into four groups: (1) unilateral soft-disk protrusion with nerve root compression; (2) foraminal spur, on hard disk, with nerve root compression; (3) medial soft-disk protrusion with spinal cord compression, and (4) transverse ridge or cervical spondylosis with spinal cord compression.

Among 175 cases of unilateral ruptured soft disk, the lesion was found at the sixth cervical interspace in 122. Among 46 cases of foraminal spur with nerve root compression, the lesion in 22 was found at this same level. This was the most frequent location for either lesion. Compression of the sixth or seventh cervical nerve root impaired the function of the muscles of the arm, but the muscular effects of lesions at these two levels did not differ enough to afford a basis for distinguishing between them. Hypalgesia observed in 173 cases affected the thumb most frequently (43 cases) when the lesion was at the sixth cervical nerve root, and the second finger most frequently (100 cases) when the lesion was at the seventh cervical nerve root. This did not afford a reliable basis for preoperative diagnosis of the level of the lesion, because with involvement of either nerve root hypalgesia was often found in more than one finger. The value of roentgenographic and myelographic methods of localizing the lesion was likewise found to be limited.

Criteria for evaluating the results of surgical treatment were applied in a follow-up study of 175 patients who were operated upon for unilateral disk: The results were excellent in 94. The results of operations for foraminal spur, medial disk protrusion, and cervical spondylosis were observed in smaller series and varied considerably from those in unilateral ruptured disk.

ALPERS, Philadelphia.

HEMANGIOMA OF POSTERIOR MEDIASTINUM WITH CORD COMPRESSION IN MIDTHORACIC REGION. J. M. MEREDITH, J. LYERLY JR., L. BOSHER JR., S. KAY, and L. OLD, *J. A. M. A.* 166:484 (Feb. 1) 1958.

Meredith and his colleagues describe a rare case of venous hemangioma located in the posterior mediastinum, with gross invasion of the adjacent intradural thoracic spaces, which caused marked cord compression and thus produced disabling symptoms in the lower extremities in a 13-year-old girl. The tumor was locally infiltrative and extended into both the anterior and the posterior extradural (thoracic) space of the spinal canal.

Surgical excision of the posterior mediastinal and spinal extradural components of the tumor was carried out in a three-stage procedure, but removal was incomplete, owing to the extensive extradural invasion of the anterior portion of the spinal canal surrounding the solid cord. Marked clinical improvement without the aid of x-ray therapy occurred in the first postoperative year, as shown by satisfactory motor and sensory findings in the lower extremities.

ALPERS, Philadelphia.

POLIOMYELITIS: EPIDEMIOLOGICAL, CLINICAL, AND LABORATORY STUDY OF THE 1954 EPIDEMIC IN NORTHERN GREECE. G. Zervopoulos, and others, *Bull. M. Soc. Salonika*, p. 259, Dec. 1956.

The incidence of poliomyelitis in Northern Greece, as well as in other parts of the country, has been very low, according to available statistical data. During the last 13 years, with the exception of 1954, the average number of cases of poliomyelitis per year in Northern Greece was 15. In 1954 an unusually severe epidemic broke out, striking 357 persons. Of those, 327 were hospitalized. The onset of the epidemic was in April, the peak in June, and only a few cases were reported after August. The authors point out that this incidence is somewhat unusual, since outbreaks are common in late summer and fall. The number of cases coming from large towns exceeded considerably the number from the rural areas and villages. The age groups affected were as follows: infants to 4-year olds, 81.04%; 5- to 10-year-old children, 16.82%.

and 11- to 17-year-old children, 1.83%. One case occurring at the age of 41 years was reported. It was noted that cases with recent (within two months) history of systemic infection, especially measles, appeared to run a severer course. The mortality was relatively greater in the age group between 5 and 8 years.

Of the 327 cases studied, 11 were meningeal, 282 spinal, 28 bulbar or bulbospinal, and 6 encephalitic. It was apparent that many of the meningeal cases could be classified as spinal forms after careful and repeated examination of muscle strength and deep tendon reflexes. The author mentions that cases of pure meningeal form are probably much fewer than is reported in statistics. Among the spinal cases, the paraplegic and monoplegic forms were the commonest. The rest of the cases represented quadriplegic, triplegic, hemiplegic, diplegic, and crossed forms. Among the bulbar cases, the association with some form of spinal involvement was the commonest feature. Among the cases involving higher centers, two were hypothalamic with hyperpyrexia, gastric bleeding, and acute stomach distention. These cases, along with four cases of cortical involvement, showed higher and longer-lasting fever. The cases with hypothalamic symptomatology showed no sign of bulbar involvement, such as is usually reported.

The cerebrospinal fluid examination revealed slight increase in protein and in lymphocytosis, up to 300 per cubic millimeter, with no change in sugar and chlorides. The author noted that the severity of the systemic reaction prior to the onset of paralysis, as well as the change in cerebrospinal fluid, allowed no prediction as to the severity of paralysis or the level of involvement.

Of the 270 paralytic patients, 145 recovered completely, 74 showed small deficits at the convalescent stage, and 51 showed severe residuals. It was noted that severe peripheral paralytic residuals were commoner in cases which originally had shown widespread involvement.

The total mortality was 4.28%. Death occurred only among the bulbar group, amounting to 50.1% of the cases.

LOGOTHETIS, Minneapolis.

News and Comment

ANNOUNCEMENTS

American Board of Psychiatry and Neurology, Inc.—The American Board of Psychiatry and Neurology, Inc., announces that three examinations will be given in 1959:

New Orleans, March 16 and 17, 1959

Chicago, Oct. 19 and 20, 1959

New York, Dec. 14 and 15, 1959



SECTION ON PSYCHIATRY

Preparedness of High School and College Seniors for Parenthood

O. SPURGEON ENGLISH, M.D.; MAX KATZ, M.D.; ALBERT E. SCHEFLEN, M.D.; ELLIOTT R. DANZIG, Ph.D.,
and JEANNE B. SPEISER, Philadelphia

Introduction

The 20th century has seen increasing acceptance of the idea that childhood experiences largely determine the personality and life adjustment of the adult. Of the childhood experiences, the relationship with the parents is crucial. Maladjustment in adults is extremely widespread. More than a million and a quarter of our citizens will spend some part of each year in a public mental hospital, and more than two million serious crimes are committed in the United States every year.¹ We do not have measures of the prevalence of psychosomatic disturbances, marital discord, disharmony in work relations, defective personality, and general unhappiness. If parental behavior toward children plays a key role in the development of these difficulties, then it can be assumed that as parents we are not doing as well as we might.

Experience with individuals confirms this idea. In the daily practice of psychiatry, one is struck forcibly by the suffering and illness which result from inadequate or improper child rearing. As we reconstruct the life histories of neurotic, psychotic, or

delinquent patients, it becomes evident that their parents knew little about constructive human relationships. When the patient is a parent, there is either evidence of confusion about child rearing or the adherence to stereotyped, handed-down attitudes toward such key problems as feeding, toilet training, discipline, and love. In an era of progressive education, with emphasis on the whole child, there has been an increase in teaching about sex education and marriage, but very little education for parenthood. Most young people seem to assume they will know how to be adequate parents when the time comes. If pressed about this point, they guess that they will use the methods that their parents used. This was true of the 30 adolescents that were interviewed before beginning this project. At the same time, these young people revealed dissatisfaction with the way their parents had treated them. All in all, there is a widespread opinion in the field of mental health that the various emotional needs in the achievement of maturation are not being adequately met by those who are parents.

There is an archaic idea, still widely held, that the child who is given food, clothing, shelter, and an education is a fortunate child indeed. Experience has shown, however, that delinquency, mental illness, and maladjustment are not a result of socioeconomic deprivation.

Submitted for publication July 15, 1958.

Read at the Annual Meeting of the American Psychiatric Association, San Francisco, May 12-16, 1958.

This study was conducted in the Department of Psychiatry, Temple University Medical Center on a grant from the Ittleson Family Foundation.

A study of the literature strengthens the idea that there is a lack of recognition of the importance of preparedness for parenthood. Few research studies have as their objective the determination of the preparedness of young people for their role as parents. Several studies^{2,4} of attitudes of young people toward their prospective mates indicated that the subjects did not consider as important the type of parents their mates might become. Doane⁵ explored the topics that adolescents would most like to have information about. Choosing husband and wife were placed eleventh on the list. Next to last, by the boys, was relations with their own parents. Questions relating to their own role as parents were not even listed by the subjects of this study. In studies of this type parenthood either was not discussed or was mentioned only in terms of such facets as being a "good cook."⁴ Hill⁶ states that "since 1942 research in marriage and the family has increased tremendously, now being ranked by sociologists as second out of 23 fields of sociological inquiry." However, he continues: "Studies which probe the conceptions of parenthood... are relatively few." Most papers describing courses for adolescents are focused on sex education and home economics.⁷⁻¹⁰ Courses on parenthood are described, for example, by Statt,¹¹ and are mostly for parents.

There have been a great many studies on the relationships of adolescents and their parents¹²⁻¹⁹ or children's concepts of parental roles.²⁰ Results permit inferences about the kind of parents these youngsters might become. In general, these investigations agreed that both parents and children could be divided into two groups: (1) traditional in attitudes toward feeding, respect, and discipline, and (2) developmental, with emphasis on emotional needs and maturation. This distinction is useful and in accord with general experience that there is a group of alerted parents attuned to children's developmental needs. Presumably their children will be "developmental." How common are these attitudes?

Are adolescents aware and listening? Some investigations have touched upon the motivations of adolescents in being parents.^{21,22}

As psychiatrists, then, we have been impressed with a lack of preparedness for parenthood and considerable lack of interest. The psychiatrist, however, does not see a representative sample of the population. There are groups of interested parents, educators, and scientists, but we do not know the extent of their influence. Even crude measurements of preparedness have not yet been made. These considerations made it advisable to try to measure preparedness in a representative sample of the general population of prospective parents. As a first step, it was decided to do this by the questionnaire method.

Methodology

Interviews with Consultants.—Authorities* representing psychiatry, child psychoanalysis, anthropology, psychology, education, statistics, theology, and social service were individually interviewed by the research team. They were questioned about the principal problems of parenthood, their predictions of the subject's questionnaire behavior, preparation for parenthood, concepts of social changes affecting parenthood, the need for further education, gaining rapport with subjects, and improving the validity of the research procedure.

These consultants later filled out the questionnaire. They were in almost complete agreement as to the most accurate answers in the information section, the most favorable attitudes toward child rearing, except in the income necessary for upper-middle-class living (Item 20), the amount of time parents should give to the child (Items 28, 30, and 31), and attitudes toward the whining child.

* Clifford R. Adams, Psychologist; Charlotte Babcock, Psychiatrist; Claude Bowman, Sociologist; Rachael Cox, Psychologist; Donald Harrington, Clergyman; Everett Hunt, Educator; Margaret Mead, Anthropologist; Emily Mudd, Marriage Counselor; Norman Nixon, Child Psychiatrist; Ira Reid, Sociologist.

PREPAREDNESS FOR PARENTHOOD

Interviews with High School and College Seniors.—Three-hour interviews were held with four groups of six to eight high school and college seniors. Usual group techniques were used to stimulate the participants to express their feelings about parenthood, about education in parenthood, about research of the type contemplated, etc. The purpose of these meetings was to enable the research team to identify themselves with the viewpoints, attitudes, feeling, and word choice of representative subjects.

In each group the adolescents said they had given very little thought to becoming parents, and they evidenced considerable lack of information. Yet each of them actively and frankly participated and showed great interest once the discussion got under way. They were most reluctant to leave, and many asked to participate in courses in parenthood.

Preparation of the Questionnaire.—The questionnaire (Table), consisting of 55 multiple-choice, and true-and-false questions, requiring less than 30 minutes to complete, was designed to obtain responses in four main areas of inquiry.

1. Information (15 questions)—fund of knowledge about generally accepted facts and practices in the raising of children (Inevitably, the responses reflect emotional attitudes as well)
2. Attitudes (15 questions)—personal attitudes to parental role and to children
3. Motivation (14 questions)—interest in parenthood. Emotional attitudes will also be reflected in the responses in this category
4. Background (11 questions)—respondents' conscious reaction to their own experiences with parents and family

Questions were constructed with deliberate ambiguity to discourage as much as possible the learned, stereotyped choices. Items were randomized in each subsection of the questionnaire and prefaced with identifying information, including age, sex, ethnic background, religion, marital status, and educational level.

Pilot Study and Preliminary Examination.—The questionnaire was filled out by 250 senior students of Temple University and approximately 150 high school seniors

in Philadelphia. These 400 questionnaires were studied and item-analyzed. Subjects were asked to write criticisms as to the pertinence, clarity, and importance of the items. Their comments were considered and discussed. On the basis of their suggestions, the questionnaire was revised.

Selection of the Sample.—Senior students of one large urban university (Temple University) and two small, upper-class, suburban, liberal arts colleges (Haverford and Beaver Colleges) were used as subjects. The high schools were chosen with the aid of the sociometric department of the School District of Philadelphia Board of Public Education, so that adequate representation of various socioeconomic levels could be obtained.

Method of Administration of the Questionnaire.—With the college groups, a member of the research team gave instructions and remained throughout the testing. Any questions asked by subjects were answered noncommittally with the phrase: "Answer according to your own interpretation." The Board of Education asked that their own teachers administer the questionnaire. Each teacher was supplied with an identical sheet requesting accuracy and sincerity and giving routine instructions. These were read to the students. Teachers asked the students not to specify their race or religion. All subjects were required not to give their names.

Reactions of students during completion of the questionnaire were of interest. Many subjects felt it necessary to ask questions, which were often unrealistic, and were felt by the researchers to give evidence of strong emotional reactions. A few students seemed to feel compelled to stand up before the class and offer lengthy, highly personal, biographical discussions, and during such abstractions they often forgot the question they had felt prompted to ask. There were many subjects who giggled, blushed, or became quite restless during the period of examination. On several occasions it was necessary to ask the students not to talk or exchange answers. Responses to certain

items were frequently omitted. General impression was that the students carried out the task in earnest, reacting with some embarrassment and anxiety, but not with ridicule or conscious distortion.

The Sample

The 972 complete questionnaires were IBM-punched and coded. The distribution of responses to each question was calculated and broken down by educational level and sex. Results are presented in the Table.

Of the 972 subjects who took the questionnaire, 271 were high school males; 256, high school females; 200, college males, and 245, college females. The high school students ranged in age from 16 to 19; the college students, from 18 to over 30. The median age was 18 for high school students and 21 for college students. The students in the sample were predominantly single. Only one high school student was married. Among the college students, about 15 were married, 2 divorced, and 1 widowed. Only 22 were parents.

The majority of the college students' parents were of the white-collar group, and the majority of high school students' parents were of the labor group. Age, geographical area, and occupational level, then, differed for the college and the high school sample, so that differences in questionnaire behavior cannot be attributed to educational level only.

With few exceptions, this sample was of native-born Americans. More than 90% of the high school students, and more than 75% of the college students were from the Philadelphia area—from urban communities.

As instructed by teachers, more than 80% of the high school students did not specify religion; none specified race. The college students were roughly 45% Protestant, 40% Jewish, and a little over 10% Catholic. Forty per cent of the college students reported that they rarely or never attended church.

Results and Comment

The limitations of questionnaire methods are well known, particularly in that they elicit only conscious attitudes, heavily influenced by a need for social approval. What should be considered a "correct" answer in our culture, what is the "normal" adolescent response to this particular questionnaire, and what interpretations are to be made from the data may be legitimately questioned and will require further investigation.

In order to determine the significance of educational level and sex, 200 randomly selected questionnaires were scored and analyzed. The only significant differences were that the female students showed higher scores in motivation for parenthood ($\chi^2=11.2$; $P<0.01$), and college seniors had significantly higher scores in the information section than did the high school seniors ($\chi^2=88.8$; $P<0.001$). These differences exceed the 1% level of confidence.

An over-all evaluation of the Table indicates intolerance to the emotional behavior of children, strong manifest motivation toward parenthood, and misinformation about parenthood (over half gave incorrect answers in 11 out of 15 items in the information section).

The responses of high school girls deserve special comment. Many of them will become parents within a few years without further education. They are also the main source of baby sitters. In this group of high school girls a strikingly high proportion (39%) prefer complete weaning from the breast or bottle before the age of 6 months; 87% would spank a child for stubborn and regressive behavior; 90% fear "spoiling" a crying infant, and 91% expect the small child to share possessions cheerfully.

Those items which inquired about the influence of child rearing on personality traits and psychosomatic symptoms showed a mixed result. Although 71% agreed that a person's personality and character are mostly the result of parental upbringing (Item 27), 40% believed that the school

PREPAREDNESS FOR PARENTHOOD

Preparedness-for-Parenthood Questionnaire: Responses by Sex and Educational Groups

	Per Cent of Responses *					Per Cent of Responses *				
	H. Sch.		College			H. Sch.		College		
	Total	M.	F.	M.	F.	Total	M.	F.	M.	F.
I. Knowledge										
20. John and Mary have three children. They have a small but new house in the suburbs, and want such things as a television, automatic washer and dryer, and a new car. What is the least income they will need each month?										
a. \$150	5	6	9	2	4					
b. \$300	45	51	43	40	44					
c. \$700	44	35	36	58	52					
d. \$1500	4	5	7	1	1					
21. Breast feeding the baby is:										
a. A waste of time	1	2	0	3	1					
b. Old fashioned and unnecessary	23	34	37	22	18					
c. Usually pleasant for the mother	51	32	47	56	73					
d. A drain on the mother's health	9	13	9	7	5					
22. As far as the baby is concerned, breast feeding:										
a. Causes colic and crying	2	2	4	0	0					
b. Makes him too dependent	13	16	12	15	9					
c. Is usually better than bottle feeding	65	44	60	73	86					
d. Leads to thumb sucking	6	12	7	3	0					
e. Prevents rickets and vitamin deficiencies	7	8	13	3	2					
23. Weaning (taking the baby completely off the breast or bottle) is usually done:										
a. Before the age of 6 months	33	31	39	36	25					
b. Between 7 and 14 months	44	35	41	39	61					
c. After 14 months	14	14	15	15	11					
d. After 2 years	4	7	2	6	1					
24. A child should be toilet trained by the age of:										
a. Six months	3	5	4	3	2					
b. One year	39	35	65	31	22					
c. Two to three years	52	49	30	61	71					
d. Four years	4	6	1	4	5					
25. A new born baby should										
a. Be handled with great care and concern	72	87	89	62	47					
b. Not be touched except to feed and change diapers so that germs will not get on him	3	5	5	1	0					
c. Kept in a warm, dry, dark place	1	1	0	0	1					
d. Be lifted, fondled and played with often	23	4	5	36	52					
26. If an older child repeatedly wets the bed most likely he does so because he:										
a. Has weak kidneys or bladder	35	59	47	20	9					
b. Drinks too much liquid before bedtime	14	15	22	9	7					
c. Has an emotional problem	44	16	24	65	79					
d. Is spoiled	4	6	4	2	1					
27. A person's character and personality is mostly the result of:										
a. Being born that way	3	2	4	1	4					
b. What he learned in school	1	1	0	1	1					
c. How his parents brought him up	71	59	68	78	81					
d. The kind of people he goes around with	21	34	25	12	8					
28. How many hours a week should a father realistically expect to talk and play with his children?										
a. 2 to 4 hours	7	7	14	2	2					
b. 5 to 8 hours	18	20	16	27	13					
c. 9 to 15 hours	43	41	37	51	45					
d. 16 to 22 hours	30	28	31	20	38					
29. In 1952 about 50,000 babies were born in Philadelphia. How many mothers would you guess died here that year in childbirth?										
a. 3	12	10	12	14	13					
b. 30	52	45	45	56	64					
c. 300	27	32	33	25	19					
d. 600	6	7	7	5	3					
30. John, who is 4 years old, often refuses to eat his dinner. His parents should:										
a. Explain why he should eat and then let him do as he likes	43	32	36	45	62					
b. Make a game of feeding him every other spoonful	27	26	29	29	22					
c. Insist that he eat, and punish him if he does not	18	30	23	10	8					
d. Coax him and offer him a reward	9	10	9	10	5					
31. When the baby arrives, parents will find they have less time for themselves. They should:										
a. Train the baby right from the start to understand that he cannot have everything he wants when he wants it	14	23	19	7	6					
b. See that their activities should not include the baby	38	28	37	50	40					
c. Save time to enjoy things together that do not include the baby	16	4	9	18	36					
d. Recognize that from now on their own needs come second	28	41	32	20	17					
32. How much of the mother's undivided attention will a six month's old baby require each day?										
a. Two hours	3	2	3	4	2					
b. Five hours	27	18	22	40	30					
c. Eight hours	35	27	36	37	39					
d. Ten hours	34	48	36	19	28					

* Responses do not total 100%, as the number of students who gave no response have been omitted from the table.

Preparedness-for-Parenthood Questionnaire: Responses by Sex and Educational Groups—Continued

	Per Cent of Responses *						Per Cent of Responses *				
	H. Sch.		College				H. Sch.		College		
	Total	M.	F.	M.	F.		Total	M.	F.	M.	F.
33. If a mother has a terrifying experience during pregnancy, she will most likely have:						42. A good parent should teach his child never to fight or argue back					
a. A normal child	68	35	69	87	89	T —	21	30	37	8	4
b. A deformed child	7	17	4	4	1	F —	78	66	61	93	96
c. A fearful child	12	19	13	6	6	43. I hate to see a little child try to get more attention than the other children					
d. A birthmarked child	8	17	10	1	1	T —	46	61	61	29	25
34. In regard to family finances:						F —	53	36	38	71	75
a. Father should handle the money	6	13	1	9	2	44. A decent 5 year-old kid would not go peeking into bedrooms					
b. Mother should handle the money	2	3	3	1	0	T —	17	34	23	3	4
c. They should work it out between them	90	80	94	90	98	F —	82	64	75	96	96
d. They should divide the money between them	1	2	2	1	0	45. A few real whippings would cure the average juvenile delinquent					
II. Attitudes						T —	17	20	29	11	8
35. Picking up an infant frequently just because he cries will spoil him						F —	81	76	70	89	92
T —	69	78	90	55	48	46. Even a small child should share his things cheerfully					
F —	30	20	10	44	51	T —	67	78	91	49	43
36. A "cry baby" or a whining child is one of the most irritating things I know						F —	32	19	7	49	57
T —	53	60	54	50	48	47. Neatness, cleanliness and good manners are more important than being happy					
F —	46	39	45	50	52	T —	11	19	18	5	1
37. A child who sucks his thumb should be punished						F —	86	78	77	95	98
T —	13	25	13	7	3	48. You cannot reason with a four-year-old child					
F —	87	72	88	93	97	T —	14	20	14	12	11
38. A good child grows up to have undying love for and gratitude toward his parents						F —	84	77	85	87	89
T —	50	76	65	32	20	49. School teachers have the major responsibility for the development of a child's personality after the age of seven					
F —	49	20	34	66	80	T —	40	50	47	27	32
39. No good son should think of marriage until his parents are provided for						F —	59	47	52	73	67
T —	29	49	44	1	5	III. Motivation					
F —	70	46	55	90	94	50. How many children would you like to have?					
40. No decent youngster would ever have feelings of hatred toward a close friend or relative						0 -	4	6	1	6	2
T —	28	49	41	11	5	1 -	1	1	1	1	1
F —	71	47	58	89	95	2 -	30	34	28	33	26
41. A child that frequently stamps his feet and says "no, no" — needs a good spanking						3 -	34	34	30	37	33
T —	65	80	87	51	39	4 -	23	13	29	18	31
F —	34	18	13	49	61	5 - 6 - 7	6	5	8	5	4
						8 - 9 - 10	4	7	4	3	2

* Responses do not total 100%, as the number of students who gave no response have been omitted from the table.

PREPAREDNESS FOR PARENTHOOD

Preparedness-for-Parenthood Questionnaire: Responses by Sex and Educational Groups--Continued

	Per Cent of Responses *						Per Cent of Responses *				
	H. Sch.		College				H. Sch.		College		
	Total	M.	F.	M.	F.		Total	M.	F.	M.	F.
51. When would you like to have your first child? (If you already have children, answer this question and the next one, from the attitude you had before you became a parent.)											
a. As soon as I can provide for one	38	23	29	52	49						
b. After all my education is finished	9	7	8	8	12						
c. After we are established and have a few dollars in the bank	27	30	21	28	29						
d. After we have bought a home, and have all the things we need to make life comfortable	19	28	31	5	6						
e. I do not want any children	2	3	1	4	1						
52. When would you like to have your first child?											
a. Right after I am married	7	13	5	7	4						
b. A year or two after marriage	78	75	87	72	81						
c. Five years after marriage	8	4	5	13	11						
d. Never	2	4	1	4	2						
53. What is your attitude toward children?											
a. I could not be happy without them	15	11	19	9	22						
b. I love them	48	30	67	42	55						
c. I like them	30	49	12	42	16						
d. I can take them or leave them	4	5	1	6	4						
e. I do not like them	1	1	0	1	0						
54. When you sit across from a child that you do not know what do you usually do?											
a. Talk and play with him	45	42	48	48	43						
b. Look at him and smile	39	32	42	31	50						
c. Ignore him	2	3	0	7	0						
d. Want to talk and play with him, but don't	5	7	4	4	3						
e. I can't answer because the places I go, I don't see many children	5	11	2	7	1						
55. If you were at a picnic which of these would you do?											
a. Spend nearly all my time playing with the children	5	3	5	5	6						
b. Want to organize children's games	11	14	13	10	9						
c. Join in or enjoy watching them	38	23	41	35	52						
d. Spend nearly all my time with people of my own age	43	56	38	48	31						
56. How do most teenagers feel about little children?											
a. Enjoy them	25	28	33	18	19						
b. Think they are cute	49	46	56	40	54						
c. Ignore them	13	10	2	26	19						
d. Avoid them	7	8	5	12	4						
e. Hate them	2	4	2	1	2						
57. How often do you imagine yourself as a parent?											
a. Most of the time	9	6	12	7	12						
b. Often	22	11	23	20	33						
c. Sometimes	44	41	50	45	41						
d. Once in a great while	18	30	12	21	9						
e. Never	6	10	2	2	4						
58. Do you and your friends talk about being parents and having children?											
a. A lot	15	4	20	8	27						
b. Sometimes	54	43	66	52	57						
c. Rarely	21	36	9	30	10						
d. Never	7	14	2	11	2						
e. More than most topics	2	1	3	0	3						
59. Would you read a book on being a parent?											
a. I would be glad to	60	39	70	53	78						
b. Only if I had to	11	22	7	10	4						
c. If somebody gave it to me	11	10	14	14	7						
d. I doubt it	15	22	8	21	11						
e. I would not	1	1	1	2	1						
60. When do you think courses on parenthood and family living should be given?											
a. Junior High School	10	15	12	10	3						
b. Senior High School	51	56	63	41	40						
c. College	6	4	1	8	13						
d. When engaged	5	7	2	7	3						
e. When married	2	2	1	4	0						
f. All through school and college years	26	14	21	30	39						
61. Do you recommend courses in school on parenthood and family living?											
a. Yes, very much	70	65	77	64	71						
b. I guess so	7	13	6	5	4						
c. Only if there is a good teacher	16	9	15	22	22						
d. I don't care	7	5	1	4	0						
e. No	2	3	0	5	1						
62. How much baby sitting have you done?											
a. Every time I get the chance	7	2	17	2	7						
b. Often	23	8	35	14	33						
c. Sometimes	37	40	33	40	36						
d. Almost never	20	24	11	31	17						
e. Never	12	24	3	14	7						
63. The way you feel about being a parent is:											
a. I need to know more about it	70	64	74	67	76						
b. I have already learned most of what I need to know	13	13	12	17	9						
c. I will naturally know when the time comes	17	18	12	12	14						
64. Would you say that:											
a. Men have an easier life than women	13	15	18	15	5						
b. Women have an easier life than men	8	14	2	12	4						
c. Neither sex is better off than the other	77	68	78	72	90						

* Responses do not total 100%, as the number of students who gave no response have been omitted from the table.

A. M. A. ARCHIVES OF NEUROLOGY AND PSYCHIATRY

Preparedness-for-Parenthood Questionnaire: Responses by Sex and Educational Groups—Continued

	Per Cent of Responses *					Per Cent of Responses *				
	Total	H. Sch.		College		Total	H. Sch.		College	
		M.	F.	M.	F.		M.	F.	M.	F.
IV. Family Background										
65. Who worked in your family when you were a child?										
a. Father	68	62	64	72	76	26	22	32	21	24
b. Mother	3	2	6	2	2					
c. Both	27	31	29	26	20	60	59	57	61	63
d. Neither	1	1	0	0	1					
66. How do the members of your family get along together?										
a. We are very close to each other	57	49	62	53	66	8	8	8	12	6
b. We fight or argue a lot and are not very friendly	3	4	3	5	2					
c. We each go our own way	6	7	4	10	4	3	5	1	4	2
d. We have some good times together	29	34	27	29	25					
67. How have you usually gotten along with your parents?										
a. I prefer my father and have trouble with mother	5	3	5	5	6	20	23	13	28	16
b. I prefer my mother and have some trouble with my father	17	20	19	14	16	24	22	28	18	27
c. I do not get along well with either parent	4	4	3	6	3	52	46	55	50	56
d. I get along very well with both parents	70	66	70	73	71					
68. Do you think your parents:										
a. Enjoyed children	71	67	75	71	71	2	2	2	3	2
b. Loved you but couldn't express it very well	24	26	21	22	25	17	17	16	14	20
c. Said they love you, but really did not	1	1	1	1	0	29	29	23	34	31
d. Preferred not to have any children	1	1	1	2	1	24	19	24	25	29
69. Do you think your parents or the people who raised you were:										
a. Satisfied with your performance all the time	9	11	10	4	10	7	8	7	8	7
b. Satisfied with your performance most of the time	82	75	84	87	82	5	7	8	3	3
c. Dissatisfied and critical of you most of the time	6	5	5	9	7	5	5	7	7	5
d. Never satisfied with you	1	3	2	0	0	9	9	12	10	5
70. Do you think that your parents:										
a. Treated you fairly most of the time	78	80	73	78	81					
b. Were too strict, and did not give you a chance to do the things you wanted	7	6	8	9	6					
c. Pushed you around and never gave you a chance to do anything you wanted	1	2	2	1	0					
d. Spoiled you	11	8	14	10	11					
71. What is your attitude toward your home?										
a. I enjoy it, and prefer to be there more than any place else										
b. I enjoy it, but I like to get away with friends quite often										
c. I am not usually very satisfied at home and have more fun when I am away with friends										
d. I do not enjoy my home and prefer to be away from it every chance I get										
72. The head of your household, and the person who made most of the decisions was:										
a. My father										
b. My mother										
c. Mother and father shared the responsibilities and decided things together										
d. My mother and father nearly always disagreed about things and often quarrelled about who was boss										
73. What is your position in the family?										
a. Only child										
b. Oldest child of two or three										
c. Youngest child of two or three										
d. Middle child of three										
e. Youngest of four or more										
f. Oldest of four or more										
g. Between the youngest and oldest of a large family										
74. The following items are experiences or situations which may have taken place in your childhood. Check the items which apply to you.										
a. Death of a parent										
b. Divorce or separation of parents										
c. Irresponsible parents										
d. Quarrelling parents										
e. Cruelty of parents, relatives or teachers										
f. Neglect or disinterest by those who raised you										
g. Parents with criminal record										

* Responses do not total 100%, as the number of students who gave no response have been omitted from the table.

teacher carries the major responsibility for personality development after the age of 7 (Item 49). The role of emotions in enuresis seems to be unknown to the majority of respondents (Item 26). Also, superstitious notions of effects on the child of terrifying maternal experiences during pregnancy were indicated in over a quarter (Item 33) and nearly a half misestimated the dangers of pregnancy to the mother (Item 29).

Several items, especially Items 28 and 32, indicate that adolescents expect to give considerably more time to children than the "experts" considered realistic. Sixty-nine per cent felt that mothers should give eight or more hours a day of undivided attention to the 6-month-old infant (Item 32). Three-quarters felt a father should be expected to give more than nine hours a week to playing with his children (Item 28). Twenty-eight per cent say that as parents their needs should come second to those of the child (Item 31). The investigators seriously doubt that more than a fraction of them will live up to their ideals in this regard. If they really expect to devote so much time, they may develop feelings of guilt, with the consequent problems well known to the psychiatrist. It is possible that these overestimations indicate wishes for more fathering and mothering on the part of these respondents. Certain other results bear out this possibility. There seems to be a tendency toward leniency about nurturance needs. For example, a total of 79% chose "lenient" responses to the question on discipline in feeding (Item 30). Eighty-seven per cent said they would not punish thumb sucking (Item 37). Only 14% would seem to consider a baby an intruder in their marriage (Item 31). This tolerance appears to extend to sexual curiosity (Item 44). A large number of the respondents, then, are at least theoretically in favor of greater nurturance gratifications for children. If this represents dissatisfaction with their personal nurturance experiences, this is probably unconscious in many, judging by the high percentage who repre-

sent their own family life experiences as ideal (Items 66-71).

Despite their intent to be lenient toward nurturance needs, responses indicate that as parents their ability to carry out this intent may be limited by (1) a need for keeping a distance from the child; (2) a fear that nurturance satisfactions will lead to "spoiling," and (3) the expectation that in return the child be devoted, loyal, and nonexpressive of infantile impulses.

For many respondents, more nurturance does not, apparently, involve close physical contact. Only half chose an unequivocally positive response to the value of breast feeding for the mother (Item 21). A third did not see breast feeding as better than bottle feeding (Item 22). Unlike, as in other items, 7% did not respond at all to these questions, suggesting that even mention of breast feeding is disturbing to some. Thirty-three per cent favored weaning at an age that the authorities consider premature (Item 23). Seventy-two per cent indicated that a baby should be handled with "great care and concern" (Item 25). This we consider an anxious answer, indicating overconcern and a need to keep a distance.

The time-honored notion that spoiling will result from gratifying nurturance needs is still much in evidence. Nearly 70% felt that picking up an infant frequently just because he cries will spoil him (Item 35). Crying and whining were consciously irritating to half of the respondents (Item 36). Nineteen per cent felt breast feeding would lead to overdependency or thumb sucking (Item 22). Thirty-three per cent favored early weaning (Item 23).

Loyalty and devotion to parents are considered very important by a large number. One-half believe a good child should have undying love and gratitude toward his parents (Item 38). Twenty-nine per cent chose a response favoring extreme devotion of son to parents (Item 39). Seventy per cent claimed to get along very well with both parents (Item 67); 91%, that their parents were satisfied with their perform-

ance all or most of the time (Item 69). Only 8% felt their parents to be too strict (Item 70). These findings contrast sharply with other data about family life and child rearing. We interpret these results as indicative of overidealization of the Pollyannaish, close, uncritical devotion of children to parents. If so, it is possible that many children of the next generation may pay in loyalty and guilt feelings for the nurturance gratifications they receive.

In contrast to the relative permissiveness toward gratification, nonacceptance of unsocial "expressive" behavior is evidenced with marked frequency. Forty-six per cent hate to see competition for attention among children (Item 43). Two-thirds are intolerant of stubbornness and defiance in a child (Item 41); two-thirds feel that a child, even at an early age, should cheerfully share with others (Item 46). Nearly one-half believe a child should be toilet-trained before the age of one year (Item 24). The strict disciplinary attitudes of high school girls have already been mentioned. In contrast to these responses, 78% think parents should teach their children never to fight or argue back (Item 42). It would appear that aggressiveness is a quality that is permissible and encouraged, so long as it is not directed at parents.

Eighty-seven per cent would like to have two, three, or four children. A third want two children; another third want three. Only 4% did not want any (Item 50).

The great majority seem anxious to have children soon and early in married life (Items 51, 52). About half seem, at present, interested in other people's children (Items 54, 55, 56). Yet 69% show little tendency to think about their own parental role (Item 57); only 15% frequently discuss parenthood (Item 58).

Seventy per cent say they very much favor courses in school (Item 61). Sixty per cent would "be glad to" read a book on parenthood (Item 59). Seventy per cent acknowledge a need for further information (Item 63). This indicates interest in learn-

ing more about parenthood. Girls show greater motivation than boys.

Two interpretations are possible: (1) The answers are heavily influenced by the need to feel in a socially approved way, e. g., "It's good to want children" and "education is a fine thing" (when talking to educators); (2) these adolescents have strong need to have children, but these needs are not freely expressed and discussed. The interviews with adolescents suggest that this nonattention is due to inhibition more than to disinterest.

We have the over-all impression that there exists a strong tendency toward unrealistic expectation and idealized attitudes about parenthood, such as overestimation of the time the respondent will spend with their children, the expectation of upper-middle-class living on low incomes (Item 20), unquestioning ideas of love and devotion between parents and children, and the accomplishment of weaning, toilet training, and socialization at an early age. Since unrealistic expectations inevitably lead to frustration and disturbed relationships between parents and children, more educational efforts might well be directed to the biological, psychological, and social aspects of child rearing.

Summary

A group of high school and college seniors completed a questionnaire designed to assay preparedness for parenthood. Consultations, interviews, pilot trials, and other techniques were used in order to make optimal use of the questionnaire and offset some of its inadequacies.

College seniors did significantly better than high school students in the information section of the questionnaire, but in the other sections there were no significant differences.

Analysis of 972 questionnaires indicates that most high school respondents lack knowledge about parenthood and evidence a high incidence of attitudes which indicate unrealistic expectations and idealization of parent-child relationships, together with

nonacceptance of unsocialized infantile traits and a fear of "spoiling" and physical contact. The respondents appear to be highly motivated to have children but describe little conscious attention to the subject of parenthood.

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Psychoses, Intracranial Neoplasms, and Genetics

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The nature of the association between the ABO blood groups and disease is being investigated in the population of the State of Iowa.¹ The demonstration of statistically significant associations between the ABO blood groups and several diseases suggests that the ABO blood groups may be a tool useful in investigation of genetic factors in still other disorders. This paper is a report of the findings in patients with psychoses and intracranial neoplasms (brain tumors).

Materials and Methods

The ABO blood types of the patients resident in Mount Pleasant and Independence Mental Health Institutes were determined by the research team, using a slide technique. The patient's blood type, diagnosis, and other relevant information abstracted from the patient's chart were recorded on punch cards. The diagnoses had previously been established by staff members of the Mental Health Institutes and were based upon the standard nomenclature of mental disorders recommended by the American Psychiatric Association.

All case records of patients with intracranial neoplasms seen at the University Hospitals since 1940 were reviewed. All cases in which an ABO blood type was recorded and a histologic diagnosis established were included in the study. The blood type, diagnosis, and other relevant information were recorded on the punch card.

Blood-type frequencies observed in the patient groups were compared with those observed in voluntary blood donors at the University Hospitals.

Submitted for publication Aug. 7, 1958.

This study was supported by Grant RG-4777, National Institutes of Health, Bethesda, Md.

Read before the Section on Nervous and Mental Diseases at the 107th Annual Meeting of the American Medical Association, San Francisco, June 25, 1958.

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Since the patients of the two Mental Health Institutes come from the same geographical area, and often are from the same families as the blood donors of the University Hospitals, the latter are thought to be valid controls.²

In earlier reports,^{3,4} differences in the blood-type frequencies between the experimental or patient groups and the controls have been examined directly for statistical significance. It has been suggested^{5,6} that the relative incidence of a disease in persons of the four blood types is a more meaningful manner of expressing the findings. Even if this is true, the statistical significance of the findings is the same with either method of examination. The statistical analysis in both instances is by means of the χ^2 method.

In this report relative incidences will be given and their statistical significance indicated. Only the relative incidence in persons of the blood type showing maximum increase in frequency in the patient group is pertinent and is given. For example, the relative incidence of psychoses in persons of blood type O follows:

Patients			Controls		
O			O		
A + B + AB			A + B + AB		
1,144			22,392		
930	230	66	:	21,144	4,695 1,748
1.15 (χ^2 10.98 0.001 < P < 0.01)					

It is to be remembered that the relative incidence by itself does not indicate the statistical significance.

Results

In Table 1 the data indicate a significant increase in the incidence of psychoses in patients with blood type O, and of intracranial neoplasms (brain tumors) in patients of blood type A. The probability is of similar magnitude in the two instances. In the breakdown by sexes, it is to be observed that the relative incidence in type O patients with psychoses and in type A patients with brain tumors is significant for males but not for females for both lesions.

TABLE 1.—*ABO Blood-Type Frequencies of Patients* with Psychoses and Brain Tumors and of Controls; Relative Incidence of Blood Type O and Blood Type A When Patient Data Are Compared with Data for Controls; χ^2 and Probability for Each*

	Blood Types										Probability
	O		A		B		AB		Relative Incidence Type O †	χ^2	
	No.	%	No.	%	No.	%	No.	%			
Psychoses											
Male	1,162	57.5	447	38.5	107	9.2	33	2.8	1.21	10.03	$0.001 < P < 0.01$
Female	1,208	569	483	40.0	123	10.2	33	2.7	1.10	2.52	$0.10 < P$
Total	2,370	1,144	930	39.2	230	9.7	66	2.8	1.15	10.98	$0.001 < P < 0.01$
Brain tumors									Relative Incidence Type A ‡		
Male	312	134	150	48.1	22	7.1	6	1.9	1.26	4.21	$0.01 < P < 0.05$
Female	253	112	118	46.6	21	8.3	2	.8	1.19	1.93	$0.10 < P$
Total	565	246	268	47.4	43	7.5	8	1.4	1.23	12.9	$0.001 < P < 0.01$
Controls §	40,979	22,392	21,144	42.3	4,005	9.4	1,748	3.5			

* Frequencies broken down by sexes.

† Psychotic patients.

‡ Brain tumor patients.

§ Voluntary blood donors

TABLE 2.—*Hospital and Sex Breakdown of Data (Psychoses); Blood Type Frequencies; Relative Type O Incidence; χ^2 and Probability*

	Blood Types										Probability
	O		A		B		AB		Relative Incidence Type O	χ^2	
	No.	%	No.	%	No.	%	No.	%			
Mt. Pleasant											
Male	321	51.1	228	36.3	59	9.4	20	3.2	1.29	9.94	$0.001 < P < 0.01$
Female	680	45.0	280	41.2	75	11.0	19	2.8	1.01	0.01	$0.10 < P$
Total	1,001	48.5	508	38.8	134	10.2	39	3.0	1.13	5.05	$0.01 < P < 0.05$
Independence											
Male	534	47.6	219	41.0	48	9.0	13	2.4	1.12	1.83	$0.10 < P$
Female	528	49.8	203	38.4	48	9.1	14	2.7	1.22	5.28	$0.01 < P < 0.05$
Total	1,062	48.7	422	39.7	96	9.0	27	2.5	1.17	6.31	$0.01 < P < 0.05$

TABLE 3.—*Psychiatric Diagnosis: Blood-Type Frequencies; Relative Type O Incidence; χ^2 and Probability*

	No.	Blood Types								Relative Incidence Type O	χ^2	Probability
		O		A		B		AB				
		No.	%	No.	%	No.	%	No.	%			
Schizophrenia	1,269											
Male	609	291	47.8	241	39.6	53	8.7	24	3.9	1.13	2.16	0.10 < P
Female	660	284	47.3	240	40.0	56	9.3	20	3.3	1.11	1.83	0.10 < P
Manic-depressive	154											
Male	46	20	43.5	21	45.6	5	10.9	0	--	0.95	0.03	0.10 < P
Female	108	51	47.2	39	36.1	13	13.9	3	2.8	1.16	0.06	0.10 < P
Involitional	107											
Male	15	6	40.0	9	60.0	0	0.0	0	0.0	0.82	0.14	0.10 < P
Female	92	42	45.6	33	35.9	14	15.2	3	3.3	1.03	0.03	0.10 < P
Total Nonorganic	1,470											
Psychoses												
Male	670	317	47.3	271	40.4	58	8.7	24	3.6	1.11	1.68	0.10 < P
Female	800	377	47.1	312	39.0	85	10.6	26	3.3	1.10	1.72	0.10 < P
Epilepsy	78											
Male	40	23	57.5	13	32.5	2	5.0	2	5.0	1.67	2.55	0.10 < P
Female	38	24	63.1	9	23.7	3	7.9	2	5.3	2.11	4.94	0.01 < P < 0.05
Mental deficiency	194											
Male	101	50	49.5	42	41.6	9	8.9	0	0.0	1.21	0.90	0.10 < P
Female	93	44	47.3	40	43.0	7	7.5	2	2.2	1.11	0.24	0.10 < P
Alcoholic	62											
Male	54	32	59.3	16	29.6	6	11.1	0	0.0	1.79	4.43	0.01 < P < 0.05
Female	8	5	62.5	1	12.5	2	25.0	0	0.0	2.05	0.97	0.10 < P
Syphilitic	67											
Male	42	21	50.0	17	40.5	1	2.4	3	7.1	1.23	0.46	0.10 < P
Female	25	11	44.0	13	52.0	1	4.0	0	0.0	0.97	0.01	0.10 < P
Arteriosclerotic	271											
Male	121	67	55.4	36	29.7	16	13.2	2	1.6	1.53	5.37	0.01 < P < 0.05
Female	150	72	48.0	63	42.0	15	10.0	0	0.0	1.14	0.62	0.10 < P
Post-traumatic	10											
Male	8	4	50.0	2	25.0	2	25.0	0	0.0	1.23	0.09	0.10 < P
Female	2	0	0.0	2	100.0	0	0.0	0	0.0	0.62	--	--
Total Organic	682											
Psychoses												
Male	366	197	53.8	126	34.4	36	9.8	7	1.9	1.44	11.83	P < 0.001
Female	316	156	49.4	128	40.5	28	8.9	4	1.3	1.20	2.64	0.10 < P
Miscellaneous	218											
Psychoses												
Male	126	61	48.4	50	39.7	13	10.3	2	1.6	1.30	9.44	0.001 < P < 0.01
Female	92	36	39.1	43	46.7	10	10.9	3	3.3	1.09	1.04	0.10 < P

However, although the findings in both instances are not statistically significant for females, there nevertheless is an increase in the relative incidence in blood type O for psychoses and in blood type A for brain tumors.

The relative incidence of psychoses was highest in males at Mount Pleasant Mental Health Institute and in females at Independence Mental Health Institute (Table 2). However, the most striking finding is the low relative incidence in the female population at Mount Pleasant, which made the highest contribution to the discrepancy between males and females.

When the data are broken down by lesion types (Table 3) the increase in relative incidence appears to be highly significant for the organic as compared with the non-organic psychoses. The marked contrast between males and females with organic psychoses is to be noted. Examination of the data for specific diagnoses reveals a statistically significant increase in incidence of epilepsy in type O females, and in alcoholic, arteriosclerotic, and miscellaneous psychoses in type O males. None of the nonorganic psychoses shows any statistically significant relative incidence increase. When the male and female data for schizophrenia are combined, $0.05 < P < 0.10$.

The relative incidence of specific types of brain tumors was not significantly increased in blood-type A patients.

Comment

The most important finding emerging from this study is that the blood-type frequencies of persons with psychoses and intracranial neoplasms differ significantly from those of the blood-donor controls. This is reflected by an increased incidence of psychoses in patients with blood type O and an increased incidence of intracranial neoplasms in patients with blood type A. These results are not in agreement with those recently reported.^{7,8} For reasons which have already been alluded to, the

TABLE 4.—Type of Brain Tumor; Blood-Type Frequencies; Relative Type A Incidence, χ^2 , and Probability

	Blood Types												Relative Incidence Type A	χ^2	Probability	
	A				O				B		AB					
	No.	%	No.	%	No.	%	No.	%	No.	%						
Glioblastoma	128	57	44.5	62	48.4	7	5.5	2	1.6					1.09	0.26	$0.10 < P$
Medulloblastoma	19	8	42.1	8	42.1	3	15.8	0	0.0					0.99	0.00	$0.10 < P$
Astrocytoma	215	101	47.0	93	43.2	18	8.4	3	1.4					1.21	1.96	$0.10 < P$
Misc. gliomas	62	31	50.0	26	41.9	4	6.4	1	1.6					1.36	1.40	$0.10 < P$
Metastatic	65	31	47.7	28	43.1	4	6.1	2	3.1					1.24	0.77	$0.10 < P$
Benign	77	40	51.9	29	37.7	7	9.1	1	1.3					1.47	2.89	$0.05 < P < 0.10$
Total brain tumors	566	268	47.3	246	43.5	44	7.8	8	1.4					1.23	5.85	$0.02 < P < 0.05$

voluntary blood donors would seem to be a valid and representative sample of the normal population from which these patients came. When one compares two groups of patient data, that is, the blood-type frequencies observed in the patients with psychoses with those observed in the patients with intracranial neoplasms, then $P < 0.001$, indicating great statistical significance.

When these results are considered together with those previously reported which indicate associations between the blood groups and peptic ulceration, gastric carcinoma, and pernicious anemia, and findings which suggest associations in hip fracture and rheumatic fever,¹ one finds support for the concept that the heterozygosity of the ABO blood groups is dependent on a dynamic equilibrium related to selective factors manifest in diseases such as those discussed.⁹ If this concept is valid, the so-called "normal" blood-type frequency merely reflects this dynamic equilibrium, which is contributed to by many selective genetic factors not recognized at this time.

The apparently stronger association for both lesions in men cannot be satisfactorily explained at this time. Although the findings in both psychotic and intracranial neoplasm patients are not statistically significant for the females, an increase in the relative incidence of each disorder did occur in the same blood type as the male. It is speculative what may be found when additional data are collected. The possibility that these findings are related to an insufficient size of the sample is supported by contradictory results when the data from the two Mental Health Institutes are compared (Table 2). In one instance a stronger association was observed in males, and in the other a stronger association in females. Likewise, no plausible explanation can be offered to explain the apparent differences between the organic toxic and nonorganic nontoxic psychoses, which suggest a much stronger association for the former group.

Here, again, more data must be collected before proper interpretation may be reached.

Pertinent to this discussion is the heterogeneity of the patients included in the organic toxic group. It is quite possible that the observed findings may be related to the underlying systemic process rather than the psychosis per se, for example, alcoholic and syphilitic psychoses. It is also to be remembered that these patients, by and large, have chronic irremediable psychoses. It will be of interest to conduct a similar study in patients with acute and more tractable disease processes.

Nothing of importance appears to have emerged from the breakdown of the data by specific diagnosis. Certainly the several types of psychoses in which some suggestion of statistical significance was found for the relative increase in blood type O merely suggest the need for more data.

Summary

The findings of a study of the possible relationship of the ABO blood groups to psychoses and intracranial neoplasms are reported. The results indicate that the incidence of psychoses is significantly increased in persons of blood type O, and that the incidence of intracranial neoplasms is increased in persons of blood type A. In both groups of diseases the association is stronger in men than in women.

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Sociodynamics and Psychotherapy

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Increased understanding of patients has led to many modifications in the evolution of dynamic psychotherapy.²⁰ Recently, as reinforcement psychologists^{4,15,22,23} and social scientists have contributed information from their disciplines, new modifications in theory and practice are developing.

Hollingshead and Redlich call attention to the need for psychiatrists to recognize social factors in their management of psychiatric patients.²⁶ In recent studies attempts have been made to show that an understanding of some of these factors seems to permit more effective treatment, with fewer visits, in the case of children^{5,9} and young married women, particularly at the time of childbearing.¹⁰

The present study will consider features of ethnic origin, socioeconomics, and mobility in these and other age, marital, and sex groups and their implications in psychotherapy. It will investigate the effectiveness of introducing new methods suggested by experimental and other studies in modern behavioral and social psychology, cultural anthropology, and sociology into the clinical practice of psychotherapy. The report will consider results of dynamic psychotherapy in patients treated by a more passive insight-giving approach as compared with a method that combined insight giving with active efforts at improving the environmental situation, as described under "Theory and Method."

Theory and Method

Two aspects of the psychotherapeutic process may be considered: (1) the gaining

of insight and extinction of fears, and (2) the development of social skills.

1. The gaining of insight into the relationships between past and present difficulties and the patient's emotional reactions and symptoms is fundamental to extinction or unlearning of pathological emotional responses. If the major dangers were in the past and the present anxieties are unrealistic, insight alone will usually reassure the patient and relieve him of anxiety and guilty fear. This involves the extinction of maladaptive anxiety and fear responses to no longer dangerous signals. Learning theory principles of the effectiveness of massed trials in extinction, reactive inhibition, and retroactive inhibition are applicable. If the present situation is partly responsible for the patient's anxiety but lends itself easily to improvement, the patient is readily relieved. Intelligent, loving, trustworthy family and friends may help considerably with this part of the process.¹

The mature adult has learned to cope with fear or anxiety by a gradual process of readying himself to face it in small doses. By personal experience, by following the direct example of a respected person, by gaining advice and information about the experience of others, or under the direct supervision of a dependable guide, he learns methods of dealing successfully with difficult situations. Thus he learns how to avoid certain realistic dangers, how to protect himself against others, and how to cope with still others. He learns to enjoy previously anxiety-provoking situations and thus eliminate discomfort. He learns which danger signals are to be disregarded as possibly meaningful in the past but now no longer associated with danger, and he also learns which danger signals re-

Submitted for publication July 9, 1958.

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quire that he take notice and take appropriate protective action. His success in coping with potential dangers and difficulties helps build his confidence in his ability to learn to cope with fears, and also prepares him for moving forward to bigger tasks. This confidence tends to generalize to other similar situations.

Facing fear is not necessarily an automatic process. Humans probably reflexly tend to avoid felt dangers. In any event, whether they would spontaneously or not, patients generally require encouragement and support in the process. If pushed by others or by themselves too fast to face, to talk about, to try to learn about, and so to face, their fears, they panic. The panic, too, may generalize, and the therapeutic process may have to start again. Each individual patient, his therapist, and his interested friends and family must come to recognize the patient's best pace, the rate at which he can expose himself to potentially dangerous signals or situations, learn to cope with, neutralize, and counteract the dangers, and thus gradually, with repetition, extinguish the pathological reactions. This is best accomplished when the patient can control his forward progress, is encouraged, but never forced to move faster than he feels able.

Since advice and support are fundamental in everyone's learning to deal with fear, it is only reasonable that therapists should consider their use. The therapist himself supports the patient. But the therapist also estimates the strength, dependability, and trustworthiness of the important persons in the patient's life. The close and loving family, properly instructed, can remove many realistic difficulties in a patient's life and thus have a major share in extinguishing the patient's unjustified fear responses. They are with the patient every day. In the case of the childbearing new mother, we have recommended use of an experienced, dependable, undominating female relation or nurse. But in other situations—for children—parents and teachers are invaluable; for

wives, husbands and relatives; for the agoraphobic, a trusted escort, etc. Fearful conditioned reflexes extinguish faster with massed trials once the dangers have been removed. These trials may take place in the patient's home with his family or in the psychiatrist's office. Experience has shown that the majority of patients whose families contain helpful understanding members and whose life situations are reasonably tolerable do well with this "social therapy," with only weekly, biweekly, tapering off to monthly, or even less frequent, sessions with the doctor, to provide the distributed training needed to make permanent the improvements.²⁷

Patients who have had little opportunity in their lives to learn to cope with fear, to face up to danger signals, to learn how to neutralize the dangers, and to seek experienced, helpful counselors in the process, may undergo devastating blows to their self-confidence if events have overwhelmed them. Their defenses by avoidance, denial, and repression have been undermined. They feel hopelessly defeated. Since their minds are preoccupied with their problems (this tendency is comparable to the *Zeigarnik* phenomenon²⁸), they find they cannot attend to, or concentrate on, other matters that people and they themselves previously conversed or thought about—literature, current events, and the like. This process of "losing my mind" contributes to the patient's greater anxiety. This symptom is common among women patients of Italian descent and will be explained later. Understanding its mechanisms, and learning it does not mean the patient is the hopeless mental case he thought he was, is relieving often in a single interview. Similarly, seeing the relation between combinations of life traumata and other psychophysiological symptoms is helpful. At present the intelligent layman does not understand these processes too well, and thus this aspect of therapy must remain solely under professional management.

Psychotic thinking deserves a few words. Patients use the language of their experi-

ence in reporting their feelings. Increased understanding of psychodynamics, sociodynamics, and psychophysiology has helped psychiatrists to realize what patients are experiencing. Many complaints previously considered hypochondriacal delusions have been found to have a basis in smooth- and striated-muscle activity. The attention and concentration difficulties, mentioned above, are real, not imaginary, and have a psychophysiological basis. Most doctors can recall the focusing of their own attention upon the problem at hand during the final examination weeks at college. We can sympathize with the patient whose problem involves the integrity of his whole functioning self, and whose only previous information has been that to be unable to concentrate on other matters, to be inattentive and forgetful, indicates hopeless mental illness.

Social factors contribute to delusion formation. Self-respect and self-confidence derive from past and present successful accomplishments and the love and respect of loved ones. The patient who feels he is failing, who is withdrawing and retreating, and cannot fight his fear and panic, realizes that he is not able to gain respect. When he avoids his friends, they do begin to talk about him. Some of the patient's ideas of reference, and some delusions of persecution, too, have some basis in reality.

Thinking disorders in themselves need not alter the procedure in the patient's management.²¹ When a patient, with all the help available, continues to face his fears, cope with his life, gradually resume responsibilities, and have fun in the process, he begins to succeed, regains the love and respect of others, and restores his self-confidence. His life experience will undergo a fundamental alteration as he realizes his own strength and ability to cope with things, supported by the loving help he has had from family and doctor. The epiphenomena of his self-reporting verbalizations are modified to fit more appropriately his new real inner experiences

with himself, with his position in the world, and with other persons.

2. The second main aspect of psychotherapy involves the learning and becoming efficient in new social skills and abilities—tactful, considerate self-assertion, work abilities—that permit the individual to exercise some greater control over his life situation. Many authors have assumed that social skills lie nascent in all of us and emerge spontaneously as soon as anxiety is diminished. But is it not so that many people have never experienced tact? Are there not whole subcultures that are characterized by inconsiderate temperamental outbursts and expressions of feelings?

Learning of skills is accomplished best not with massed trials but with distributed training. Thus, patients who need to learn social and work skills, and who have passed through much of Stage 1, do not require frequent visits. But they do need occasional sessions for learning, review, rehearsal, and practice. Perseverance, for example, is one of the most important of all social skills. It is related to patience and persistence and is fundamental to maturity. The experimental psychologists have taught us how perseverance is learned by appropriately rewarding smaller, then larger, and still larger efforts.^{13,18,19}

The psychotherapist can make good use of the social environment in helping the patient develop the social skills necessary for successful and happy functioning. This may often require that the patient join clubs, groups, schools, and other organizations where persons with such skills are available for help and example. Of course, the therapist also teaches the patient himself.

Occasionally, when the family is unable to cooperate, or may be openly hostile to the patient, the situation may be very difficult and punishing. It takes *only an occasional punishing experience to maintain a pathological response once it has been established*.²⁰ Those patients whose present-day life situations are difficult present severe problems in therapeutic management. When they have done well in therapy, and

they often require frequent and numerous sessions, it is a tribute to the therapist's technique in handling the transference so that these patients can extinguish their fearful reactions with him and generalize the learning to the rest of the world. A patient in this kind of situation must also learn new, more efficient, nonprovocative skills in interpersonal relations which enable him to assert himself and yet be considerate of others, for without these skills he will provoke others to hurt him again and again, and thus perpetuate his disorder. He must learn to avoid and to protect himself against others. He must develop extraordinarily good judgment as to what steps are appropriate at any given time.

Procedure

Hollingshead and Redlich²⁰ have suggested that methods used in psychotherapy and education with problem children could possibly be applied to dynamic psychotherapy with adults. They believed that such procedures would enable lower-class patients to receive more help. This agrees with the hypothesis of this study. Moreover, since the same techniques were used with child patients throughout the five years of the study, the therapeutic experiences with children may serve as a control for those with adults.

In this study, 699 case records of Bergen County (N. J.) private-office psychiatric patients were analyzed for data regarding age, marital status, ethnic origin, intermarriage, socioeconomic status, and suburban migration in the same manner as that described in previous papers.^{7,8} In addition, the number of psychotherapeutic sessions and the outcome of psychotherapy were ascertained, whether success or failure, whether patient rejected therapy, or whether patient was hospitalized in a psychiatric institution.

The patients were divided into three groups, in the manner reported in another paper¹⁰: The 264 patients first seen in 1953-1954, when psychotherapeutic treatment was more passive, dynamic psychotherapy alone; patients seen in 1955, the transition period, data for whom were not used in the study; and 307, first seen in 1956-1957, when a more active sociodynamic and psychodynamic procedure was used. Thus, if social forces are important and more readily managed in the emotional disorders of certain patients than of others, there should be a difference in therapeutic response on the part of certain groups and that of others as a result of the change in therapeutic method. Child-

dren treated in 1953-1954 and in 1956-1957 by combined insight and social therapy in both periods served as a control group. χ^2 -Calculations were made to determine the probability of occurrence by chance.

Results

There is a very apparent difference in response to therapy in the various patient groups. Children generally did better than adults ($P<0.01$); girls and single women did better than boys and single men ($P<0.01$), and young married people did better than involutional psychotic and aged persons ($P<0.01$) (Table 1).

Response to Social Therapy.—However, much of this difference changed as a result of introduction of a new therapeutic method. The children showed no over-all im-

TABLE 1.—*Therapeutic Results with Different Groups**

	No.	Few Sessions (Less Than 20)	Many Sessions (20 Plus)	Total	Rejected Therapy
Young single men	70	26%	12%	32%	31%
Young single women	58	41%	14%	55%	12%
Young married men	110	38%	10%	49%	28%
Young married women	119	32%	10%	42%	33%
Childbearing women	67	44%	10%	54%	24%
Involutional men	55	25%	0	25%	25%
Involutional women	82	16%	4%	21%	54%
Older men	19	26%	5%	32%	35%
Older women	21	14%	5%	19%	43%
Total Children	601				
Boys	73	40%	12%	52%	36%
Girls	25	68%	4%	72%	12%
Total	98				

* The different criteria of success were number of sessions—few or many, — and whether the patient accepted therapy.

Comparative percentages of therapeutic success for patients of different age, sex, and marital groups are presented. It is apparent that therapy was more effective with single women than with men ($P<0.02$), and with young married men than single men ($P<0.05$). However, single women did better in therapy than married women. Young married men responded better than married women ($P<0.10$); childbearing women did better than other young married women ($P<0.05$). Results were poorer with involutional patients and older men and women than with young men and women ($P<0.01$), and with involutional and older women than men (P not significant). Children did better than adults ($P<0.01$).

TABLE 2.—Comparative Over-All Therapeutic Results Before and After a Change in Psychotherapeutic Technique*

	Year	No.	Sessions	Rejected Therapy	Hospitalized
Adults	1953-1954	243	Few 20%	38%	15%
			Many 9%		
	1956-1957	252	Few 43%	24%	6%
			Many 10%		
Children	1953-1954	21	Few 43%	24%	0
			Many 19%		
	1956-1957	55	Few 53%	27%	0
			Many 9%		

* A comparison of the over-all effectiveness of the two forms of psychotherapy in the experimental and control groups is presented as measured by several criteria. When social factors were managed in 1956-1957, there was more successful brief therapy ($P<0.001$) involving fewer hospitalizations ($P<0.01$) and fewer rejections ($P<0.01$). The conformity of the several measures may serve as a test of their reliability and validity. The control groups of children showed no significant change other than a greater tendency for successful results to be achieved with fewer sessions. Approximately the same percentages of patients required many therapy sessions before and after addition of social therapy.

provement, as they received the same type of therapy throughout, and served as a control group. But there was a marked improvement in the response of adult patients, once social therapy was added, by every criterion (Table 2).

The degree of response to change in therapy varied according to the patient's sex, marital status, and age category (Table 3). Childbearing and other young married women responded very well to the new

approach. Single men, patients with involutional psychoses, and the aged also improved, but married men and single women showed no over-all change for the better or worse (other than a slight, but significant [$P<0.05$] tendency for these groups and the children to require fewer sessions).

Suburban Migration.—New resident married female patients, particularly in the maternity group, responded much more readily to few sessions than did young

TABLE 3.—Comparative Improvements in Various Patient Groups with a Change in Therapeutic Technique*

	1953-1954			1956-1957		
	N	Sessions		N	Sessions	
Single men	26	Few 12%	27%	31	Few 31%	46%
		Many 15%			Many 15%	
Single women	21	Few 29%	53%	28	Few 43%	54%
		Many 24%			Many 11%	
Young married men	48	Few 33%	50%	37	Few 49%	55%
		Many 17%			Many 6%	
Young married women	60	Few 15%	15%	51	Few 41%	63%
		Many 0			Many 22%	
Childbearing women	23	Few 17%	33%	33	Few 64%	64%
		Many 16%			Many 0	
Involutional and older men	24	Few 13%	17%	37	Few 33%	33%
		Many 4%			Many 0	
Involutional and older women	41	Few 12%	12%	35	Few 20%	29%
		Many 0			Many 9%	
Controls (children)						
Boys	14	Few 36%	64%	38	Few 42%	51%
		Many 28%			Many 11%	
Girls	7	Few 57%	57%	17	Few 77%	83%
		Many 0			Many 6%	

* The childbearing and other young married women made the greatest over-all change ($P<0.01$), while single women and married men showed little improved response, other than a tendency to need fewer therapy sessions. Single men and involutional and older patients were intermediate in improvements.

SOCIODYNAMICS AND PSYCHOTHERAPY

TABLE 4.—Length of Residence in the County and Therapeutic Response*

	Sessions	N	Older Residents	N	Newer Residents
Maternity women	Many	22	18%	25	16%
	Few		23%		64%
Young married women	Many	59	25%	33	10%
	Few		32%		40%
Young married men	Many	48	9%	19	5%
	Few		46%		32%
Total no.	Many	129	18%	77	10%
	Few		31%		46%

* Older residents are defined as those living more than five years in Bergen County; newer, those residing less than five years. Female older residents required more therapy sessions, and female new residents responded to fewer sessions. However, there was no relation between length of residence and number of sessions in a comparable group of married men patients. More new-resident maternity psychiatric patients responded with fewer therapy sessions than did other group.

married men. Generally, among the married women, older residents required more sessions and new residents fewer sessions ($P < 0.01$). This was not true of married men patients (Table 4).

Socioeconomic Status.—Our data on socioeconomic status (Table 5) show, first, that the patients were almost entirely lower-middle and middle-middle class. There were a few from the laboring class and the upper-middle class. There were very few wealthy upper-class patients. Jewish Americans tended more to the higher socioeconomic categories; Italian Americans, to the lower, and intermarried, Protestant, other Catholic, and Irish Catholic Americans were in between, in that order of decreasing fre-

quency. Fifty-one per cent of single-men patients were downwardly mobile socioeconomically, more than any other group. For comparison, the figure for married men was 7% ($P < 0.001$). Downwardly mobile patients generally did poorly in therapy.

Age.—The mean age of 59 single young men was 24, and that of 58 single young women, 27 (critical ratio [C. R.] = 2.24; $P < 0.05$). Younger men exceeded women in numbers, as boys exceeded girls. By the age of 30 numbers of women exceeded those of men.

Among the involuntal and older women, the group from 45-49 were 29 years older than their youngest child; those from 50-59

TABLE 5.—Socioeconomic Status and Ethnic Origin*

	Patients, % of Total	Norms, %	Upper & Upper- Middle Classes I & II	Middle- Middle Class IIIa	Lower- Middle Class IIIb	Laboring Class IV & V	Men	Women	Total No.
Irish Catholic	12%	4%	10%	22%	53%	14%	24	25	49
Italian Catholic	12%	15%	8%	22%	58%	14%	23	28	51
Other Catholic	10.5%	21%	18%	19%	55%	8%	14	30	44
Protestant	27%	25%	18%	21%	55%	7%	44	68	112
Jewish	15%	11%	20%	60%	18%	3%	26	38	64
Intermarried	23.5%	24%	25%	26%	44%	6%	26	73	99
Total	100%	100%	18%	29%	46%	9%	157	262	419

* A description of the norms and the various social levels appears in a previous paper.* The great majority of both patients and norms come from the skilled-laboring and white-collar groups.

Jewish American patients, more than any other ethnic group, came from the higher socioeconomic categories. Intermarried, Protestant, other Catholic, Irish Catholic, and, finally, Italian Catholic Americans followed, in that order. Data for age, marital status, and sex are not shown, but the lowest socioeconomic group included mostly single men and women. The patients included more Irish Americans and Jewish Americans, slightly fewer Italian Americans, and considerably fewer Catholics of other ethnic origins than the norms. The largest percentages of Jewish Americans occurred among young married men and single women. The highest percentage of Irish Catholic Americans were among single young men and women. Percentages of Protestants were highest in the involuntal and aged groups; intermarriages among married young women, childbearing women, and couples consulting together primarily for marital problems.

were 30 years older, and those of the 60+ age group were 34 years older.

Ethnic Origin.—The patients included larger percentages of two very mobile minority groups, the Jewish and the Irish Americans (Table 5). More Jewish Americans appeared than the norms percentage-wise ($P<0.05$); 18 of 30 men (60%) did well in therapy. The Irish Americans also exceeded their population percentages, as measured by the norms ($P<0.05$).

Patients of Irish and Italian Catholic background were fairly comparable socioeconomically. However, the number of young single and married Italian American women almost doubled the number of men (30 to 17), while Irish American men slightly exceeded women (21 to 20) in (comparison of the two ethnic groups, $P<0.05$). However, among the involuntional groups, numbers of men of Italian descent considerably exceeded the number of women, and women of Irish descent exceeded men in numbers ($P<0.01$). Of 17 of the Italian American single men who came into treatment, 7 did not do well, as compared with 1 of 30 women of that ethnic group ($P<0.01$). A similar pattern was present among the married and older groups of Italian descent. No similar sex difference in therapeutic response was observed in any of the other ethnic groups.

Education.—High school graduation was associated with greater chance of a successful outcome in psychotherapy in a group of married women patients. Only 58% of women patients who had not graduated from high school did well in treatment, as compared with 80% of women who had graduated. Only 21% of women patients who started college completed four years. This compares with the 1950 census figure for Bergen County women, which shows that 49% of those who entered college completed four years ($P<0.01$).

Comment

These studies seem to support Hollingshead and Redlich's thesis. Environmental

influences and educational procedures traditionally used in the treatment of children apparently permit effective treatment of certain adults with fewer patient sessions. The procedures seem to have a basis in learning theory and permits a *rapprochement* between it and psychoanalytic theories.

It appears that the patients who did well with fewest sessions were as follows: 1. Those whose disorders were associated with the acute strains, such as recent suburban migration or childbearing. Pointing out the difficulties to patients and their families, with simple suggestions as to possible methods of adjusting, resulted in most instances in rapid improvement. 2. Those for whom there were understanding and helpful family members available who were in a position to influence their lives and who were able to serve as therapeutic aides and assistants. Discussions with them, always in the presence of the patient to prevent misunderstandings, pointing out how they might best assist the patient, seemed highly beneficial to the patient's progress.

The methods of therapy described seemed effective with patients of most socioeconomic classes and ethnic backgrounds. However, certain groups sought help more readily than others and seemed to benefit more from it.

The therapist may help remove negative influences in the environment more readily with children if parents and schools can cooperate, and with married women, particularly with disorders of childbearing, if a helpful husband and dependable female relatives or nurses are available. The social improvements they can provide help remove the acute strains and permit a dying-out of pathological reactions to no longer dangerous stimuli, and reintegration of the patient's personality organization with fewer doctor-patient sessions.

On the other hand, therapists usually have little influence over the important social forces in their men patients' lives. For instance, psychiatrists in private practice usually do not have the same liaison

with employers as they do with schools. If the environmental strains cannot be alleviated, the patient must continue under pressure until he has benefited sufficiently from psychotherapy alone to effect changes himself in his surroundings and his inner adjustment. This requires a many-session, time-consuming effort. Thus, men patients generally did not show the increased response to social therapy. In the Army, and perhaps in industrial psychiatry, the situation might be different.

Single women benefited little from social therapy. The community is relatively favorable for them, and generally they did fairly well with dynamic psychotherapy alone. The therapist is unable to assist them much in finding a spouse or a better job, and thus has less influence over the environment than with other groups.

The effectiveness of a few sessions of psychotherapy with married women who are new residents in the community as compared with men, on the one hand, and with long-time women residents, on the other, support this explanation. New resident children, too, responded more readily to a few sessions in psychotherapy.⁹ Women's and children's strains and pleasures come more directly from the home, neighborhood, and community; men's, less so. Simple counseling as to methods of adjusting to a new way of life, and assistance in the process, would seem, therefore, to have more effect with housewives. The long-time residents generally are not suffering from acute transition or mobility strains and thus should not be expected to respond so readily to simple social procedures. Married men suffer less from geographic mobility than their wives and children. The home and community to them is only the place they hang their hats, they maintain continuing relationships at work when they move to the suburbs.²⁵ Their suffering may occur with job mobility, such as that which occurs when military service interrupts their careers, or in economic depressions.

Women generally seek help more than men. Their role is changing rapidly in

America. Women have more to gain from psychotherapy. They seek, and more readily accept, insight into their strivings, and assistance in using their rational powers and intelligence to facilitate the process. This is true of women of all ethnic groups, but it is particularly striking in the more upwardly mobile groups. The greater numbers of partly educated women among patients would point to a greater sense of frustration in the career-marriage dilemma in which women often find themselves.

Such considerations may help explain therapeutic experience with male patients, as contrasted with female, of Italian descent. These men sought help less, percentage-wise, as boys,⁹ and through most of adult life, than did girls and women of the same ethnic background, or patients of other ethnic groups. In treatment, also, they received less benefit. Socioeconomic class is not a sufficient explanation, for, although these patients were drawn largely from lower classes, their status was no different than that of women of Italian descent or of other men patients of Irish background, who sought help more and generally responded better. Second- and third-generation Italian American men and women are undergoing a difficult cultural assimilation.^{3,16} For the women, motivation to adjustment is probably greater, for the new goals of social equality and educational and work privileges provide a stimulus to achievement. The young Italian boy may still receive a much higher status than his sister in the home, but the American culture around him demands much of him as a man, including what he may consider a sacrifice of masculinity in his new relationship with a wife in marriage. He may tend to fight this rather than seek assistance in adjusting to what is to him a downgrading. His wishes for a returning to his former position of relative power are not within the ability of the therapist quickly to grant. Thus, the Italian American man is often too disillusioned to continue in psychotherapy. His feminine counterpart, by contrast, is usually delighted with psycho-

therapy, continues, and responds well to it. She seeks to be considered, treated, and helped to be an equal. It is also not difficult to explain why many intermarriages involving Italian-American husbands result in marital conflicts, regardless of the wife's religion. The wives are the ones who usually seek therapy.

The social environment, the role the patient plays, and the therapist's opportunity to help influence the environment can also explain in part the response of other groups to therapy. Involutional patients and older persons also did not do as well in therapy as did their juniors, but improved once they were shown better how to adjust to their changing roles. The woman whose children were everything to her, and who have now grown up and moved to a new community, has to develop new interests in later life. Women who had worked before marriage or had community interests responded quicker. (These women tended to have an emotional disorder after their youngest child grew up. Thus, patients who were relatively older when they sought help usually had children much younger than themselves.) The man whose life has been devoted to an attempt to succeed in business and has fallen short of his aspirations as time for retirement approaches, has to reorganize his sense of values and begin to enjoy community activities, his family, hobbies, and the like. Here, too, we find a special problem of the first- and second-generation older Italian American—the only age group in this ethnic group in which males exceeded females. The Italian patriarch has a very difficult time adjusting to his children's growing up, Americanizing, and leading their own lives. He is used to the large, close-knit family, and is not prepared for independent living, with each husband and wife standing as a unit, with its own interests and activities. Efforts at helping him adjust have to take into consideration how much he feels he is giving up and how little he can do to prevent it. The therapist must assist him in developing new interests, which for the patient may

mean adjusting to an unaccustomed and worse way of life.

Percentagewise, more men and women of the second and third generations of Italian, Irish, and Jewish descent consult us than do patients from the less upwardly mobile subcultures of Polish, Czech, and other groups in the community. As social scientists have observed,¹⁷ the second and third generations have greater adjustment problems than the first, later, or old American groups. Second- and third-generation Americans who have assimilated the values of the American culture, and who seek to rise socioeconomically, often require psychiatric assistance. Within a single family, the members who are more Americanized may consult psychiatrists, while the less mobile have less cultural (and inner) conflict and may feel less strain.

Throughout modern history the Jew has had to adapt himself to new environments and cultures. Of necessity, the use of education, intelligence, thought, and planning have been traditional to the European Jews (and their American descendants). Thus, they readily have turned to psychotherapy as a rational approach to improving their adjustment to society. In the young married group as many men sought help as women, and the majority continued to a successful termination of therapy. More Jewish Americans, percentagewise, appeared than their community percentatges. As shown previously,⁹ they brought their children more readily than any other group. This may in part reflect their higher socioeconomic status, but every therapist has noticed the relatively greater therapeutic readiness of the Jewish patient, male or female. Jews aspire higher, expect more of themselves educationally and socioeconomically, and thus are prone to feelings of failure if they do not achieve. Thus, they seek help more readily, and, valuing the use of thought and intelligence in solving problems, they are usually willing patients who do well in a therapy that uses rational processes to help control social and emotional forces.

Life is harder for the member of a minority group who is trying to come up in the world rapidly. Being a woman, belonging to a minority, or being in a low-income category is not in itself associated with emotional disorder. Rushing to do something about it apparently is what results in trouble. As described previously,⁸ potential patients tend to rush ahead thoughtlessly to a premature and unrealistic "pseudo-independence," oftentimes to escape from the painful experiences of unhappy childhood dependency, authoritarian parental upbringing, and discrimination against minorities. Thus they produce new difficulties for themselves.

Single men had a relatively difficult time in the suburbs.⁸ The inability of the marginally adjusted to keep up with the competitive struggle is reflected in their undergoing emotional difficulties at an earlier age than the single women and their tendency toward downward socioeconomic mobility. As emphasized in a paper on children's problems,⁹ boys and young men receive less guidance, assistance, and help from their fathers and other male models and examples than do girls from their mothers. Much is expected of them by the culture, but oftentimes they have had inadequate preparation and training in social skills and practical abilities to cope with their responsibilities. Moreover, patients without opportunities for social advancement cannot help feeling less hope. This may contribute to withdrawal, apathy, loss of self-respect, and the development of more serious disorders. They feel that they have little to gain from pure insight therapy without work and educational opportunities.³¹ The socioeconomically declining cannot help feeling distressed in an American society, with so much emphasis upon advancement. However, when efforts were directed at helping them get ahead, they did show increased therapeutic response. In general, it would seem that men and boys with problems need more social assistance from employers, clubs, and the like, than is now available. Thus, psychotherapy has

been less effective in general than with girls and women.

There seemed to be almost as many long-term cases percentagewise among adults after social psychotherapy as previously. A certain percentage of patients have long-standing problems and difficult social situations. These patients must remedy the situations by their own efforts. The therapist can only help them obtain insight and reorganize their emotional reactions and overt patterns of behavior. His only weapons are his kindness, understanding, and the influence of the doctor-patient relationship. A hard core of chronically ill patients will continue to require many sessions of psychotherapy.

It would seem generally that therapists can most readily help patients who have an opportunity to improve their situations, or whose social environment can be bettered with the cooperation of family and friends. In the upwardly mobile social climate of this country, it seems more difficult to help the patients with a difficult environment and hardest with those whose situation is worsening.

Part of the lessened rate of hospitalization in 1956-1957 in all groups may be attributed to the introduction of tranquilizers. These may exert a greater action selectively upon the more acutely disturbed, such as the maternity patients, accounting in part for such patients' greater ability to continue in outpatient care. It is likely that these drugs enable acutely disturbed patients to calm down, discuss their problems, and learn how to improve the situation and help themselves. There was only a slight, and not statistically significant, lessening of rate of hospitalization in the groups of patients with whom socially oriented therapy was less successful. Tranquilizers alone appear of limited value, but in combination with proper psychotherapy are of considerable benefit.

Hollingshead and Redlich have suggested³² that psychiatrists heed Freud and learn through research to make psychotherapy accessible to a larger number of pa-

tients. These studies, in which knowledge from modern experimental psychology and sociology, as well as dynamic psychotherapy, is applied, indicate that this may be possible. Better understanding of patients' sociodynamics, as well as psychodynamics, enlistment of available supports in their lives, and application of techniques borrowed from the modern reinforcement psychology laboratory have resulted in apparently successful therapy in patients of lower social class and previously resistant ethnic groups. Oftentimes, therapy has consumed fewer patient sessions. One therapist can readily help several hundred new patients a year.

It must be emphasized that the reader must not assume that these studies have established finally any of the points suggested. However, the results are suggestive. The findings of this and those of previous reports tend to confirm each other in the importance of present and past social stresses in the lives of many patients, and the benefits from their management in the patient's psychotherapy. Perhaps other social scientists will test these findings in clinics in other areas of the country.

With women whose emotional difficulties were associated with childbearing there was a definite relationship between the numbers of previous and present-day stresses they underwent and the severity of their disorders, as measured in necessity for hospitalization and numbers of psychotherapeutic sessions.^{7,10} This quantitative relationship between severity of illness and numbers of psychological stresses probably occurs within each patient group. However, in estimating the seriousness of a patient's disorder and the possibilities of his benefiting from psychotherapy, it is apparently necessary also to consider the nature of his social environment. This varies considerably, depending upon the patient's role functions in the changing American scene. Patients with improvable circumstances will tend to respond more favorably, even though they have suffered many psychological hurts, and vice versa.

It would seem, then, that, analogous with laboratory data with conditioning, the strength of a pathological response is a function of the number of repetitions of painful experiences. (Some, of course, are more painful, and thus more effective, than others.) But extinction requires repetition of the danger signal without the punishments. Patients for whom it is difficult to remove the punishments in the environment do not respond so readily. In both social therapy and dynamic psychotherapy alone there are continual efforts at reducing the numbers of punishing circumstances, as well as repetitions of the danger signals which are to be unlearned. But when it is possible to improve the environment, a combined approach seems to produce better results.

Illustrative Case Histories

CASE A.—This case illustrates the management of an acute disorder of childbearing in a severely disturbed woman. Difficulties of her childhood and early life combined with those of later life to distort her personality development. But fortunate environmental supports were available to aid in her improvement. Some of the many important difficulties of her life are italicized and numbered.¹⁰ The same procedure is followed in the subsequent cases.

(1) *A 37-year-old woman*, three months after delivering her (2) *second daughter*, consulted a psychiatrist, complaining of confusion, excitement, and peculiar thoughts. She believed her family doctor was talking to her, putting sex ideas in her head, influencing her all day long. She was not very angry about this, as she felt he was trying to help her, but she did want some explanation as to what was going on. She was unable to sleep, continually talked about doctors and sex, made continual sexual demands of her husband, and was very disturbing to him. The patient was the (3) *fourth*, and youngest, child of a (4) *55-year-old father* and a (5) *42-year-old mother*, of fifth-generation *Protestant middle-class mixed American* descent. Her husband, (6) *aged 31*, was a second-generation (7) *Catholic American* of (8) *Italian-born laboring-class* parents.

This patient had suffered (9) *a previous emotional disturbance* two years previously, when her first daughter was one year old. At that time her

emotional difficulties followed a series of (10) three miscarriages. *Following a suicidal attempt*, she was hospitalized on a psychiatric ward for two weeks. She improved after four months of psychotherapy and sought no further help until the present illness.

This patient's parents not only were older but had a poor relation to each other and to the patient. Her father was (11) *alcoholic*, and her mother kept him in the cellar when he was drunk. Her father died (12) when the patient was 15. The parents and three, much older siblings had little to do with each other, each concerned himself with his own problems. They had considered the patient's birth an unfortunate accident, and the whole family left her to fend for herself as early as possible. The patient's (13) 62-year-old sister had suffered an emotional disorder after separation from her husband.

The patient grew up solitary and unwanted, soon learning that she could not depend on her family but must pursue her interests independently. However, she completed high school and (14) *one and one-half years of college*. She had held one job as a telephone operator for four years and was in the Coast Guard for one and one-half years. She liked sports, particularly ice-skating. The patient's pseudoindependence, lacking the guidance and example of loving parents, led to poor judgment, foolish decisions, and oftentimes poor relationships with friends and relatives. She had (15) *married her first husband at 19*, during World War II, and lived with him for two months, before he entered service. After five years of unhappy marriage, in which he drank and abused her, she *divorced him*.

Fortunately, the patient's present husband's family were close, affectionate; and, most important, the husband's mother and three sisters were experienced with children. However, they tended to be worrisome and emotionally unstable. (16) *His father had suffered a severe depression* a few years previously but had responded to electroconvulsive therapy. The patient had never sought any advice, baby-sitting services, or any other assistance from either her own family or her in-laws. She was a (17) *newcomer to the community* which was her husband's home, having moved over from New York City four years previously, soon after her present marriage.

As mentioned earlier, the patient had undergone three miscarriages, in addition to her two normal pregnancies. (18) *During her most recent pregnancy she had spent eight weeks in bed*. However, there were no other complications, and she delivered a normal baby uneventfully.

During the patient's pregnancy she became, for the first time in her memory, very conscious of strong sexual feelings, particularly during an

antepartum examination by her family doctor. Previously, she had submitted passively to sexual relations with her husband, without particular interest. But now, although she and her husband abstained because of her fear of miscarriage, her desire was considerable. She experimented for the first time in her life with masturbation, with much fear and guilt. She began to feel as though she were being watched and controlled for the first time. These feelings were not severe, and she mentioned them to no one until just prior to consulting a psychiatrist. By that time she had become convinced that her sexual feelings were part of her doctor's treatment. She believed that he was "trying to help her," and the treatment required her to perform vigorous sexual activity with her husband, including several perversions. Her husband was quite taken aback by this sudden change in her interests and manner and her incessant demands upon him. He reacted with anger and withdrawal, and, when he relented and participated, with shame, fear, and guilt.

This patient required heavy doses of tranquilizers in her psychiatric care to calm her and permit sleep. She and her husband were seen semiweekly for three weeks. First efforts were to reassure both of them that the patient's new-found sexual interest need not be frightening, that it merely required understanding, time, and experience to work out a mutually satisfying natural arrangement. Both the patient and her husband were cautioned to be patient with each other, as they were not going to solve this and their other problems overnight. This was somewhat reassuring to both.

It was pointed out that, although the patient concentrated all her energies in trying to solve her sex problem, she had a good deal more that was upsetting her. Since the arrival of their first child, but particularly since the beginning of her second pregnancy, she and her husband had had no social life, no opportunity for sports (which they both enjoyed), and had not even been to the movies. She worried unnecessarily about the children, their health, and their development, and was overly solicitous that they not be deprived, as she was. She could see that she did not seek counsel or assistance from the women in her husband's family, or friends or neighbors, although they were eager and able to be of help. Her own family had never been anything but critical and rejecting of her, and it never occurred to her to seek help from others. She actually had no idea that such help existed in life.

An early consultation with the patient, her husband, his mother, and his unmarried sister was useful in showing the patient how much they wanted to help her. This led gradually to an increasing reliance upon her in-laws as guides, as-

sistants, and reliefs. (This woman was fortunate to have married into a large, still closely knit Italian American family. They had thought it unnatural that she had not been closer to them in the early years of the marriage, especially after the birth of her first child. They were most pleased and welcomed her depending upon them once she began. Their loving assistance permitted the patient to begin to make fundamental changes in her behavior, as well as self-understanding.)

The patient's excitement and impetuosity and her husband's impatience slowly subsided. Their sexual adjustment became excellent, much improved over that previous to her disorder. Her interest in perversions abated as her initial curiosity and excitement were satisfied. A closer bond between the patient, her husband, and his family developed, with much interdependence, love, and reliance. She learned, with their help, to depend on others. As a result, the patient felt more emotionally secure. She enjoyed a fuller, more relaxed life, knowing she could rely on them for advice and help, and could leave the children in competent and loving hands during the day and for evenings out with her husband. She began to skate and enjoy other sports with friends and her husband again, and began visiting museums with him and the children.

The patient's delusional ideas disappeared gradually. She made no mention of them after the sixth session. Because of them and her behavior during a stormy two-week period at the onset of her disorder, it had almost been necessary to arrange for hospitalization. Her husband was almost as upset and excited as she in his worry and annoyance at her abnormal thoughts, demands, and behavior. But as is now the rule in experience with these patients with acute disorders associated with childbearing, showing them that they need and can get help usually produces a dramatic response, with quieting of even very abnormal behavior. Altogether, the patient and her husband required 18 sessions over a period of eight months.

With this type of patient it may be advisable in the future to have periodic psychiatric check-ups every three months for an indefinite period. She has not had time to develop sound judgment. A chance for review of her plans and activities can do her no harm, and may safeguard against future errors.

CASE B.—This young man's difficulties were predominantly from the past. His present situation was excellent, and extinction of his fears with few psychotherapeutic sessions was easily accomplished.

A 33-year-old married white automobile mechanic, of second-generation German Protestant descent, sought help because he had been increasingly worrisome for several years. A week

previously, while eating, his jaw began to "jump out of place." He could not control it and feared lest it would remain stuck, either open or shut. He sought medical attention and was referred for psychiatric consultation.

The patient was a lifetime resident of his community, where he attended (1) *two and one-half years of high school*. He left school at the age of 18, during World War II, to serve with the Field Artillery in France and Germany. He saw much combat but suffered no injuries, undue nervousness, or other untoward effect. He was discharged honorably in 1946, reaching the rank of Pfc after three years' experience.

The patient's father had (2) *committed suicide when the patient was 15*. He had been (3) *out of work for over five years*, had become increasingly despondent and irritable, and had undergone several weeks of *observation in a mental hospital*. He had been a Nazi sympathizer. The patient and his nonidentical twin brother had had many arguments with their father on this and many other subjects.

The patient had been close to his mother, who had recently died. Living on relief, without help and with constant worry over her husband, and with two young, growing boys, she had become (4) *very worrisome and nervous*. The patient's brother (5) *also suffered an emotional disorder* but was now recovered.

Upon discharge from military service, the patient took a job as a car mechanic in a local garage. He worked steadily there for 11 years. He married a girl of German-Scandinavian Protestant extraction, from a nearby town, soon after she graduated from a teacher's college. They had a 2-year-old son at the time of his psychiatric consultation. They were happy together, and had bought a new home, furnishings, and appliances. As with many young American couples, his earnings barely covered their monthly expenses, which included many installment payments and a mortgage on their home.

The patient's nervousness began consciously soon after his marriage. It increased with the birth of his son. He began to be very concerned lest the child fall and hurt himself or otherwise become ill. He began to worry about his own health, which had always been excellent, and about losing his job. With the onset of the recession in the fall of 1957, a new management took over the garage in which he worked, and began cutting commissions and laying off men. He could little afford a cut in income with his expenses and responsibilities. (6) *With several of his crew, he left and found a new job* in another nearby garage. The patient suffered no loss of income, but became acutely anxious with this move. He had been working in his new job about six months when he sought help.

The patient's problem was managed in one 45-minute interview. The above history was obtained in about 20 minutes alone with the patient. The next 10 minutes was used to show him how his anxiety mounted in proportion to his responsibilities—marriage, wife and son, home, time payments, and, finally, worry about his job, lest he suffer a cut in income and not be able to meet his expenses.

He could readily understand how his father's being out of work during the depression and early war years, along with his sympathy for the country of his birth, led to his mental illness, depression, irritability, and suicide, when the patient was a boy. These experiences had created much insecurity and worry in the family. It had left marks on the patient—fears of losing his job, of financial insecurity, of illness, and, particularly, of developing an emotional disorder. When he was single, and without major responsibilities, this potential anxiety lay dormant. But the daily contact of his wife and son, and concerns regarding living expenses, stirred forgotten reactions from his childhood of the insecurities, arguments, and worries he, his brother, and mother had felt. Having been through bad times, he dreaded a recurrence. Understandably, having to leave a steady job and embark on a new one was another jolt. Then, as so often happens, he began to experience the somatic manifestations of anxiety, involving not only bodily sensations but difficulties in memory, concentration, and attention. These aroused fears of physical or mental disorder, such as his father's and compounded his misery. His understanding of how worries tend to focus attention helped him understand his concentration difficulties, with much feeling of relief.

For the final 15 minutes, his wife joined the discussion. She, too, could understand why he had developed his anxiety symptoms. They then discussed how they could help themselves. First, he had already shown himself when he changed his job that he could keep at work. Times were different than when his father had his trouble, and, as he put it: "They always need good mechanics now." He was pleased to add that the garage he left was doing badly, which showed him that he had done the right thing in switching.

They were reminded that his wife had excellent training and that teachers were in great demand. They agreed that it is no disgrace in modern life for married women to work as teachers. On the contrary, there is a need for them to do so. Since teachers' hours coincided with their children's in school, married teachers have less difficulty in reconciling their homemaking and child-rearing functions. The patient was greatly relieved, and laughingly repeated a remark that "Having a teacher for a wife is like having money in the

bank." (Of college women graduates generally, teachers make the happiest marriages and have the least divorces.²)

The couple were shown how, as their responsibilities mounted, the husband's anxieties increased, because of his unusual past experience—unrealistically, as well as realistically—and their many debts, so that his being out of work even temporarily would create hardship. They were cautioned in the future to weigh carefully the advantage of new possessions against the strains and worries of meeting payments. If they were to save to provide against a possible emergency, the husband's realistic anxieties could be expected to diminish.

The couple were encouraged to continue discussing their plans, worries, and ambitions readily with each other. Discussion clarifies problems and leads to sensible plans, foresight, and action.

The patient felt reassured that he would not inherit his father's disorder. He could see how his father's inability to get a job for years and his ethnic origins were largely related to his depression and suicide.

This case history provides a starting point for comparison with others in which the patients do not respond rapidly. First, regarding the social and economic circumstances, the patient had made an excellent marriage with an intelligent, understanding, stable girl, who gave him affection and encouragement, as well as being in a position to provide financial assistance by working if necessary. Additionally, he was in a skilled trade that was in demand and permitted him to change jobs and maintain his economic position during the recession.

Extinction of fear responses from childhood is contingent upon repeated presentation of the danger signals without the dangers. With an emotionally unstable wife, who herself could offer no economic security, as well as job insecurity, progress would have been slower. In our upwardly mobile society, economic failure is most demoralizing to a man. Under these circumstances, the patient's fear of following in the path of his father would have had greater justification. If he had left his first job and had been unable to get a new one, he would not have made rapid progress. If he were to assume more burdens, such as to acquire more children rapidly, not only in-

curing more expense and greater strain on his wife, preventing her from being able to seek outside work if necessary, but also overcrowding their small house, painful experiences would be continuing and the pathological responses originating in the past would get reinforcement from present painful circumstances.

Given the same material situation, a man of different ethnic origin might have more difficulty. Consider a person of Italian Catholic descent who still held close to the values of the older generation of his ethnic group. With a dichotomized conception of male and female roles, he could not so readily feel secure about asking a wife who was better educated than he to help support the family in time of need. As a Catholic, he would feel guilty about controlling the growth of his family so as not to jeopardize its security.

CASE C.—This case illustrates the long-term therapy problem. The individual himself must build his own life, without help from persons in his environment.

A 22-year-old single man, of third-generation Irish Catholic American descent, sought help after (1) *a medical discharge from the military service*. He was ashamed, depressed, and confused. His disorder manifested itself by repeated episodes of traveling without leave away from his Army post. He would take a bus in any direction but home and would travel for several days, remembering little of what was going on other than that he was frightened, feared "they were coming after" him, and felt that he must keep going. After several days of travel and many hundred miles from base, he would regain his composure, wire the post, and return, only to set out again several weeks later.

The patient was the younger son of middle-class parents. His father had finished high school and held a clerical position, of which he was not fond, but which he, nevertheless, handled satisfactorily. He was a quiet, retiring man, who was neither close nor unfriendly with his (2) *two sons, two daughters*, and wife. He had few friends, and enjoyed primarily watching television. Mother was a competent housewife. She, too, was not demonstrative and enjoyed similar simple pleasures. The older brother, three years the patient's senior, had finished college and entered business, where he was doing well financially. He was interested primarily in getting ahead materially, and establishing a home and family. He was well on his way to his

goals. Two much older sisters also had married happily and were doing well materially.

There were no particular stresses in the patient's early life. He was in good health, not athletic, but studious. He attended parochial schools and a Jesuit (3) *college*, where he made average grades. In high school he became interested in history and joined the school history club, his only outside group activity. Socially, he had a few dates, and usually went to the movies. In college he learned to enjoy reading and symphonic music, and became interested in serious literature—the Russian classics, Hardy, Mann, and Dickens. There he majored in history and joined the political science and history clubs. He made a few friends and had a brief interest in a young college girl of upper-middle-class background. Although he felt she was equally attracted to him, (4) *he drifted away from her*, feeling that he was not her social equal.

After leaving college (5), *he accepted a clerical job* similar to his father's, but in which *he was much discontented*. Plans for the future were vague; he contemplated trying to get into the State Department, or trying to get ahead in business, or becoming a college teacher, a lawyer, or a teaching Jesuit. He was called into military service after an unsettled year of work at the same job. Six months later he required psychiatric help.

The patient's therapy consumed a total of 75 sessions, over three years. When he began treatment, he had very little self-respect, had no work, no plans, and was disgusted with himself for his failure in the Army. He could readily understand the origins of his dilemma in the initial interviews, as he realized that he had absorbed from his teachers and friends in high school and college (6) *intellectual aspirations that his family did not share, understand, or care to support and encourage*. His parents were contented to live their retiring lives; his brother and sisters had been captured by the material upward striving of the suburban community in which they all had spent their lives. No one had intellectual-humanitarian-artistic-philosophical aspirations (which are a large part of Irish cultural tradition). Thus, no one encouraged or wished to assist financially the furtherance of his education. Frustrated in his job upon leaving college, ashamed of his inability to accept the rough and ready military life, which he did not enter voluntarily, uncertain as to his ultimate goals, and with no one to understand and encourage—he had run aimlessly away from the Army post (but not toward home). An upwardly aspiring person in a community that praises and rewards upward mobility and criticizes failure cannot help losing self-respect and self-confidence when he repeatedly has not succeeded. Even worse, although anxious to get ahead, he had

no clear notion of where to and no one to guide him. The therapist accepted that role.

It was apparent that, before all else, he had to get a job, as after several weeks he did. Next, he needed companions of both sexes, with intellectual interests similar to his and with sufficient experience as to areas of application of these interests that he could enjoy and learn from discussions with them. He needed more knowledge and personal experience in these areas of his interest. He needed enough pleasure and fun out of life to provide relaxation and rest from the daily pursuit of his goals. He needed support and encouragement as he began gradually to apply himself in the pursuit of new experience, stimulating friends, more knowledge, and a place for himself. These needs he recognized in the first few interviews.

As it turned out, he also needed someone to hold him in check, for once he began to taste the kind of life he wanted he tried to bite off too much and got indigestion. At one time he had a full-time job in an insurance firm, was studying three courses at night in graduate school, was studying insurance courses in preparation for qualifying examinations, and was very active socially with interesting men and women friends several nights a week. He could not heed warnings that he might not be able to do everything well, and, in his joy and sense of freedom, he took a large role in a community play. With less and less sleep and with examinations coming on, he found he could not concentrate, first on the lines to be memorized, then on his daily work. As this occurred, he began to become dissatisfied with himself, and began to get the old feelings of failure; and, as his thoughts focused more and more on himself and his problems, could not study in school, dropped his courses, and quit his job.

This depression was short-lived, for he now knew what he wanted and had come to respect the limitations beyond which humans cannot push themselves. He was learning to pace himself at the rate of psychological development which was optimum for him. He took a new job as a clerk in a drugstore, in which his responsibilities were minimal and his work surroundings congenial, and concentrated on his studies, reading, and finding more stimulating friends. He returned to school, took two courses, and did well. He continued to do excellently with biweekly, and later monthly, psychotherapeutic visits. As a result of many conferences with other graduate students and teachers, he was quite clear in his goal of preparing for the teaching profession. Trimonthly reports to discuss his plans, difficulties, and progress have continued.

Many patients like this last arrangement, especially those who are continuing to cope with the

rapidly changing environment of an upwardly mobile life program or have had serious realistic problems, the recurrence of which they would like possibly to prevent. Perhaps psychiatrists should advocate semiannual psychiatric reviews, such as other medical practitioners and dentists recommend. It does seem particularly helpful with patients who have had serious difficulties in judgment when under stress.

This patient's personal psychodynamics, which were not covered in this report, had much to do with the field of his aspirations, as well as with his withdrawn, unassertive nature. But his sociodynamics—the absence of guides and supports for his particular interests in his immediate environment, in combination with the powerful over-all American cultural push to get ahead—made for the largest part of his dilemma. Therapy provided not only insight and a guide in the person of the therapist, but also a planned (by the patient and the doctor) exposure to graduate school groups who shared his intellectual interests. Insight into the past alone does not always help the person who is incompletely prepared in goals and education to cope with the expectations of an upwardly mobile society. Seeking out the social organizations, the right kind of work, stimulating friends, clubs, educational institutions, and the like is often necessary.

Many more seriously ill patients than this one are helped by group psychotherapy,⁶ Fountain House, and the open hospital¹² to begin to socialize. Later, with work, clarification, and pursuit of interests, and with the emotional support of good friends, they can move forward with the rest of the culture. The present environment alone, if stressful enough, can upset a person's emotional equilibrium. It can prevent extinction of past fears and anxieties if the patient gets more blows in the present than his system can withstand. Or the present environment can permit a rapid extinction of past fears with verbalization, insight, and repeated discussion, as in Case B. In Case C the patient by his own effort had to provide himself with a suitably stimulating and rewarding present situation, so that in

time he could extinguish his pathological reactions.

Summary

It has been proposed that efforts at improving the patient's environmental situation might permit effective psychotherapy with fewer doctor-patient sessions. Such procedures have been used successfully with children, and might be applicable to certain adults.

An investigation is described involving 601 adults in the experimental group, and 98 children who were used as controls. In the principal study two groups of adults were used, those for whom dynamic psychotherapy alone was applied and those for whom social therapy was added. Two groups of children served as controls. They both were treated with combined social and dynamic psychotherapy. The adults responded significantly better with social and dynamic therapy than with insight therapy alone. The two groups of children showed no marked differences.

There were considerable differences among various groups of adult patients in their responsiveness to the addition of social therapy. Women whose emotional disorders occurred in association with child-bearing responded the best; other young married women also did well; single men and involuntal and older men and women improved somewhat. Young married men and single women showed no great change in therapeutic response. Children generally did better than adults. Girls and single women responded better than boys and single men.

Married women who were new residents to the community responded better than longer-resident married women. Women of Italian descent did better than men of similar ethnic background. Jewish patients generally did well. Younger groups did better than the involuntal and older groups. The socioeconomically declining groups did poorly. High school graduates did better than nongraduates.

These differences are discussed. It is suggested that the groups who responded better were those in whose lives the environment could more readily be improved, whereas the life situations of the others were less easily influenced.

It would seem that understanding of sociological factors may contribute to good management of many patients. An effort is made to interpret some of the findings according to principles of systematic learning theory.

Since one observer's findings may be subjected to various errors, it is hoped that similar experiments will be tried in efforts to test these observations.

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Energy Transfer Systems in Schizophrenia

Adenosinetriphosphate (ATP)

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The energy concept in psychiatry and psychodynamics has been emphasized again and again by many authors. In this concept an interplay of forces has been postulated to occur at a psychological level. The terms psychic energy and libido have frequently been used in psychiatry to emphasize this energy hypothesis. The "economy principle," as defined by Freud, has concerned itself with cathexis, i. e., the investment of energy in a particular situation or object. The control of libidinous energy by the various defensive mechanisms was described as counter-cathexis. In later psychiatric and psychologic theory the concepts of motivation, drive, and need are closely related to hypotheses of energy relationships; and from this it is presumed that the drive, need, or motivation sets into action certain central energizing processes directed toward a particular expressive goal. However, the operational definitions of these concepts have been limited to patterns of overt behavior, and the introspective descriptions of such phenomena are to a great extent metaphorical.

On the more pragmatic level in psychiatry, one is concerned with the energy activities of the organism as demonstrated in behavior. The psychomotor activity, responsiveness, attention, sexual behavior, work output, and affectivity give some index of the energy output of the person. Descriptively, some psychiatric patients, particularly

those suffering from schizophrenia, may be apathetic and markedly retarded, while others are restless, agitated, and excited, and may completely exhaust themselves through their excessive energy output. Some patients are uninterested in any type of work activity and resist this, while others are overactive, scattered, and disrupted in their approach to a work task. Other patients are bland and apathetic throughout in their affective responses, or become explosively reactive, and in such periods exert much energy that is poorly directed. These observations on schizophrenic patients were reported in detail by Kraepelin,¹ and subsequently confirmed by Bleuler² and many others.

The biological source of energy rests in certain biochemical processes involving the breakdown of food. One of the most important substances in the metabolic processes of energy production is adenosinetriphosphate (ATP). This is a chemical compound, specifically, a nucleotide, occurring in all cells throughout the body. This compound acts by transforming the potential energy of the food to the kinetic energy characteristic of cellular processes. Figure 1 illustrates the manner in

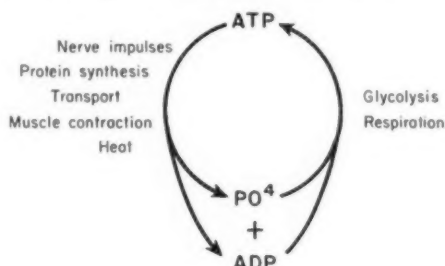


Fig. 1.—The adenosinetriphosphate (ATP)-adenosinediphosphate (ADP) cycle, illustrating the production and utilization of energy.

Submitted for publication July 30, 1958.

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Presented at the 114th Annual Meeting of the American Psychiatric Association, San Francisco, May 16, 1958.

which the loss of a phosphate ion produces adenosinediphosphate (ADP) from ATP and energy is liberated. This energy accounts for bodily processes such as maintenance of body temperature, muscle tone and contraction, neuronal activity and nerve conduction, synthetic processes, assimilation, absorption, and detoxification. The breakdown of one mole of ATP results in the liberation of a large amount of energy, approximately 12,000 Cal. At the expense of fuel metabolized, the resulting ADP is continually reconverted to ATP.³ As a method of study of this cycle, radioactive phosphorus is utilized to measure the rate of ATP formation.

In this study, these biochemical processes have been investigated in schizophrenic patients. The stimulus for this investigation came from earlier work suggesting a deficit in the mechanism responsible for the conversion of chemical to kinetic energy in patients with schizophrenia.⁴ Additional reports in the literature suggesting a disturbance in the mechanism of phosphorylation in patients with schizophrenia added impetus to this inquiry.⁵⁻⁸

Method

The following subjects have been studied: eight nonpsychotic control subjects, six early schizophrenic patients, and seven chronic schizophrenic patients. The early schizophrenic patients have had symptoms of less than two years' duration, and are divided into two groups, those in clinical remission and able to maintain themselves out of the hospital, and those clinically unchanged and still hospitalized. The chronic patients, all hospitalized, have had psychotic symptoms for four years or longer. All subjects were males, 18 to 35 years of age, normal physically, and without a history of serious physical disease or injury. In all cases, estimated intelligence was average or above. Height and weight were within 20% of the defined ideal for the subject's age. Electrotherapy or insulin therapy had not been administered within a year, nor were the patients receiving any pharmacotherapy. Before the institution of the study, both groups of patients and the control subjects lived within the hospital for a minimum of four weeks. During this time they received a carefully controlled standard diet with vitamin supplements. No subject was studied experimentally until all the following metabolic indices were within normal

limits: glucose tolerance, cholesterol-cholesterol ester ratio, albumin-globulin ratio, eosinophil count before and after corticotropin, and hippuric acid excretion following benzoic-acid ingestion. All these biological indices were found to be normal under proper dietary control.

It should be emphasized that ATP activity within erythrocytes is the focus of this report. After maintaining basal levels of activity for five days in the subject, 30 cc. of blood was drawn. Twenty-five cc. of blood was incubated for one hour with 0.5 mc. of radioactive phosphorus (P^{32}). Acid-soluble phosphates were removed from the cells by extraction with trichloroacetic acid and then isolated by precipitation with barium. ATP was then separated by ion-exchange chromatography.⁹ The amount was determined through ultraviolet absorption and other chemical methods.¹⁰ The degree of radioactivity was measured. On a later day, the same procedure was repeated, with the addition that the patient had received 10 units of regular insulin intramuscularly as a chemical stressor one-half hour before the blood was drawn. Sufficient repeat studies administering 5 units of regular insulin intravenously warrant the conclusion that the results are due to the stressor effects of insulin, and not to the variations in absorption. Many other intermediates of metabolism, such as adenosinediphosphate, fructose-1,6-diphosphate, lactic acid, pyruvic acid, adenosine-monophosphate, and ribosephosphate, were deter-

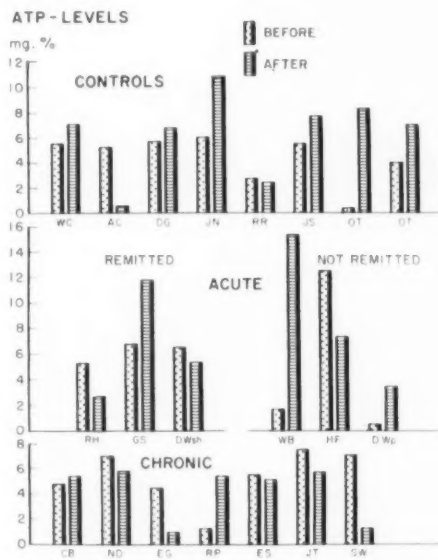


Fig. 2.—Levels of ATP, in milligrams per cent, before and after insulin in three groups: control subjects, acute schizophrenic patients, and chronic schizophrenic patients.

mined also at these times. The results of the studies of these substances will be subsequently reported.

Results

Figure 2 presents the levels of ATP before and after insulin. The control subjects are represented on the top line, the early schizophrenic patients on the middle line, and the chronic schizophrenic patients on the bottom line. In the control group the levels of ATP were in general higher following chemical stress with insulin. In contrast to this, the levels after insulin declined in the chronic schizophrenic patients. In the acute group the results were variable and demonstrated high degrees of change, as well as reduced responsivity.

To understand these results, one must appreciate some aspects of the chemistry of ATP. As was seen in Figure 1, ATP is continually releasing energy with the loss of phosphate ions and conversion to ADP; resynthesis of ATP from ADP continually occurs. Although the energy available to the cell depends partly on the level of ATP, the rate of breakdown and resynthesis of ATP is much more important. The more quickly this cycle occurs in a unit of time, the greater the amount of energy released.

With this in mind, the amount of phosphate ion incorporated into ATP in a 30-minute period of incubation, using P^{32} as a radioactive tracer, was measured.

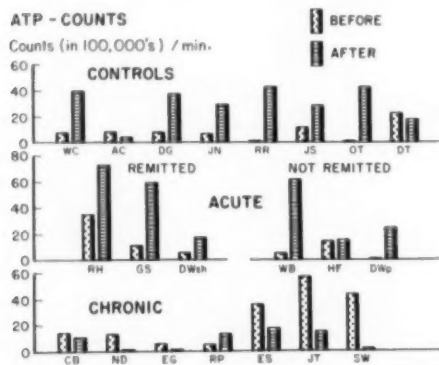


Fig. 3.—Radioactive counts of P^{32} per minute incorporated in ATP during one hour of incubation for the three subject groups before and after insulin.

Figure 3 illustrates radioactive counts and indicates the rate of formation of ATP for the subjects. In six of the eight control subjects insulin produced an increased rate of formation of ATP. In all seven patients with chronic schizophrenia insulin produced a significant decrease in the rate of formation of ATP. In the acute schizophrenic patients the picture was similar to that of the control subjects, but, again, there was considerable variability which suggested that some of these patients had a higher rate of formation of ATP than any of the control subjects or chronic patients.

To express more carefully the significance of these findings, one must take into account both the levels of the compound and the rates of formation. Such a measure is defined in radioactive counts per milligram per minute and is called the specific activity of the compound.

Figure 4 illustrates the levels of specific activity for ATP. In the control group seven of the eight subjects showed an increase in specific activity under chemical stress. All seven of the chronic schizophrenic patients showed a significant decrease in specific activity of ATP under stress. The patients in acute remission showed a rise with stress of specific activity

ATP - SPECIFIC ACTIVITIES

Counts/min. (in 100,000's) / mg.

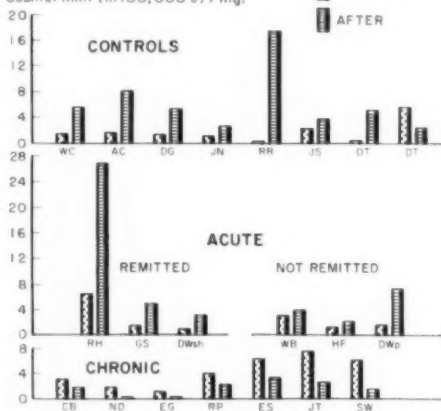


Fig. 4.—Specific activity (radioactive counts of P^{32} per minute per milligram) of ATP in the three subject groups before and after insulin.

ENERGY TRANSFER SYSTEMS IN SCHIZOPHRENIA

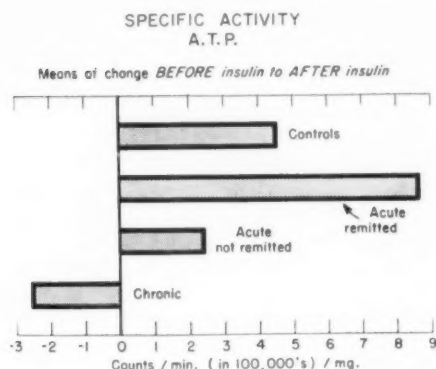


Fig. 5.—Means of difference in the specific activity of ATP from before to after insulin in four groups: control subjects, acute schizophrenic patients in remission, acute schizophrenic patients not in remission, and chronic schizophrenic patients.

similar to the control subjects. Two out of the three acute patients not in remission showed only a very small rise in specific activity under stress.

Figure 5 presents the means of the amount of change in specific activity under stress for each of the groups of subjects. The control group increased; the acute patients in remission increased more than the control group; the acute patients not in remission increased less than the control group; the chronic patients decreased significantly.

Comment

These results indicate a basic intracellular chemical disturbance of energy formation within the erythrocyte of the schizophrenic patient. This disturbance is principally made manifest when there is need for the organism to mobilize energy rapidly. The stressor used has been a chemical one. However, it is probable that other stressors, specifically psychological ones, would also result in a failure in the mobilization of energy for schizophrenic patients. Further studies are in progress in this area.

Erythrocytes have been used because they are the cells most readily available for study. Ideally, one would want to repeat these studies using neurons. This is not practical

at the present time. However, the finding that energy mobilization is disturbed in erythrocytes suggests that a widespread dysfunction of intracellular metabolism exists. This, however, is still to be proved. If such a disturbance of immediately available energy supplies is present within neurons, it could alter thresholds of firing significantly, and in this way lead to a widespread dislocation of timing and patterning, which clinically might become manifest as the disturbances in associations and affectivity.

The chronic schizophrenic patients show the disturbance in energy transfer clearly. The findings in the acute group are inconsistent, but there are several factors here that may be of considerable significance. First, the highest levels and rates of formation of ATP occur in these acute patients, suggesting that some process of overcompensation is in operation. Second, there is a suggestion that those patients who did not have a remission had less increase in specific activity of ATP than those patients who had a remission. This suggests the beginning of a state of failure of energy formation. Because of the complexity of the method and the strict criteria as regards the preparatory state of the patient, the collection of an adequate-sized population to answer this question is slow, but our studies continue in this direction. The chronic patients seem clearly to be in a state of impaired energy mobilization.

It should be pointed out that the results do not suggest that a defect in schizophrenia is necessarily in ATP formation itself. A series of biochemical reactions characterize the breakdown of a carbohydrate before the potential energy in glucose is made available to synthesize and resynthesize the high energy bonds of ATP. This disturbance may be somewhere in the carbohydrate metabolic pathways between glucose and ATP. Recent biochemical work suggests that several pathways are available, some of these being high energy-producing, and others low energy-producing.¹¹ As has been mentioned, a number of different compounds involved in these series of reactions have

been measured. Through the study of the rates of formation of these compounds, the direction of search for the isolation of the individual enzyme systems actually involved in blocking the pathway for ATP turnover may be more clearly defined. Such studies should clarify the question of whether a biogenetic defect, a circulating enzyme-inhibitor substance, or some other process is involved in this aspect of the pathophysiology of schizophrenia.

Summary

Clinical and experimental evidence has suggested a defect in energy mobilization in patients suffering from schizophrenia. Consequently, the intermediate carbohydrate metabolism that is concerned with energy production is under study in patients suffering from this disease. For practical reasons, the mechanisms within the erythrocyte are the focus for these studies. All subjects were carefully controlled for nutrition and energy output.

This report is limited to the levels, the radioactive turnover, and the specific activity of adenosinetriphosphate (ATP), under basal conditions and after insulin stress. The levels of ATP were in general higher in the control subjects, lower in the chronic patients, and variable in the acute patients after stress. The same directions of change occurred in the measures of radioactive turnover.

The most significant findings were in the specific activity of ATP after stress. These demonstrated a striking increase in the control group, an even greater increase in the acute patients in remission, a very small increase in the acute not in remission, and a marked decrease in the chronic patients.

The significance of the energy failure for the pathophysiology of schizophrenia is discussed.

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Gastrointestinal Function and Mood Alterations

Intestinal Absorption in Mood Disorders

JOSEPH B. PARKER JR., M.D.; MALCOLM P. TYOR, M.D., and JULIAN M. RUFFIN, M.D., Durham, N. C.

Gastrointestinal symptomatology and function in mood disorders have long¹ been of interest to both the psychiatrist and the internist. The findings of Henry² that gastrointestinal motility is retarded in depression and accelerated in an elation of mood have generally been accepted.³ Gastric motility and secretion have been reported to be altered during acute emotional situations.⁴ Other reports have been contradictory.^{5,6} These differences may have been due to a difference between an acute emotional state and a sustained one, as suggested by Farr.⁵ Objective or measurable methods of rating the mood states and changes have generally been lacking.

Available methods of measuring absorption have limited investigators in studying this function in normal as well as pathological mood states. Gildea et al.⁷ contrasted oral glucose tolerance curves with intravenous curves of glucose utilization in manic-depressive patients and interpreted differences as indicating that the absorption of glucose was delayed in the manic-depressive patients.

There are a number of gastrointestinal disorders which are characterized by impaired digestion or absorption of foods. In

such instances a defect involving fat is one of the most readily and profitably studied. The usefulness of the ¹³¹I-labeled triolein test as a measure of fat absorption has been widely accepted.⁸⁻¹⁰

In the present study intestinal absorption was measured in this manner and the results contrasted with the alteration in mood. In view of the earlier work cited, it was assumed that absorption would be delayed in depressive moods and possibly accelerated in moods of elation.

Subject Material and Clinical Data

The patients studied consisted of 35 men without any evidence of gastrointestinal or endocrine disease. Patients were chosen who clinically displayed psychomotor retardation, secondary weight loss, and other biological concomitants of depression and an expressed depressed mood; or an increase in psychomotor activity, speech, and energy to a degree that required closed ward treatment. Although all subjects had lost from 10 to 30 lb of weight, none had any overt signs of malnutrition or vitamin deficiency.

Twenty-five patients were depressed; ten were abnormally elated or in a frank manic state. Thirteen of the depressed patients were in the depressed phase of a recurring manic-depressive illness when first tested. The remaining 12 depressed subjects either suffered from severe reactive depressions or had decompensated with a depression of mood from a long-standing psychoneuroses. All of the elated patients had a history of previous abnormal depressions and elations. None of the subjects had any evidence of a primary thought disorder or what has been described as pseudoneurotic schizophrenia.¹¹

The average mean age of the depressed group was 40, and ages ranged from 23 to 63. The median age was 41. The mean age of the elated group was 41, the ages ranging from 33 to 62, with the median age 42. The ages of the 20 normal control subjects ranged from 27 to 64, with the mean age 43 and the median age 40.

Submitted for publication Aug. 6, 1958.

Supported in part by U. S. Public Health Service Grant A-1987GM.

Read at the 114th Annual Meeting of the American Psychiatric Association, San Francisco, May 12-16, 1958.

Associate Professor of Psychiatry (Dr. Parker); Assistant Professor of Medicine (Dr. Tyor); Professor of Medicine (Dr. Ruffin), Duke University School of Medicine.

From the Departments of Psychiatry and Medicine, Veterans Administration Hospital and Duke University School of Medicine, and the Radioisotope Laboratory, Veterans Administration Hospital.

Method of Study

The technique of the lipid absorption test used was a modification of the method described by Baylin et al.^{10,11} An emulsion of peanut oil, water, and polysorbate 80 U. S. P. (Tween-80), containing 25 μ c. of I^{131} -labeled glycerin trioleate (triolein), was given in the morning after a night's fast with 20 gm. of barium sulfate. Twenty drops of a saturated solution of potassium iodine was given to block the thyroid uptake of radioactive iodine. Blood samples were drawn at 2, 4, 5, and 6 hours (and 24 hours for the psychiatric group). The subjects ate a lunch after the fifth-hour sample was drawn. Urine-free feces were voluntarily collected for 48 hours after the test meal; however, collections were continued for 72 hours when total 48-hour excretion weighed less than 200 gm. or when barium was still present in the colon at 48 hours.

Radioactivity of the blood samples was determined by a scintillation well counter. Fecal radioactivity was determined by a D25-3P scintillator with a probe attachment in the manner described by Baylin et al.¹²

Mood and psychomotor activity were determined by clinical interview, behavioral rating scale¹⁴ by two separate raters, and a subjective mood scale (Hildreth¹⁵) during the above procedure. Minnesota Multiphasic Personality Inventories¹⁶ were done either during or in the same week as the absorption test was performed on all the testable manic-depressive group and in some of the remaining depressed groups. When the patient mood disorder had remitted clinically; that is, he had had successful trial leaves, and in 12 cases had returned to regular employment, all test procedures were repeated.

The mean blood and fecal radioactivity of the depressed group was compared statistically with corresponding values obtained from a group of 20 control subjects. A similar comparison of data was performed for the elated group and the control subjects.

The radioactivity and subjective mood data obtained from each patient in the depressed and elated groups, before and after a clinical remission, were analyzed by comparing the means of paired data with a "*t*"-test for significance.

Subjects' Reaction to Procedure

All of the depressed manic-depressive patients readily agreed to the procedures and, with one exception, more or less passively accepted their lunch being delayed for the five-hour blood sample. Some of the depressed neurotics muttered complaints to nearby ward personnel. The manic sub-

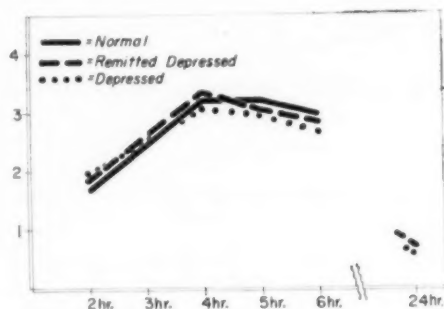


Fig. 1.— I^{131} blood percentage: depressed group.

jects, on the other hand, told all available listeners and sought persons in authority to tell that they were tired of waiting. They complained of alleged inefficiencies or expressed variations of a complaint that no one cared if they starved.

Results

There was no significant difference in blood radioactivity or in fecal radioactivity between patients with active mood disorders ($P > 0.05$), either depressed or elated, and a group of normal control subjects (Figs. 1, 2, and 3).

The pathological mood state remitted by clinical evaluation, psychomotor measurements, and subjective mood scale to a statistically significant degree ($P < 0.01$ in the elated group and $P < 0.001$ in the depressed group). The MMPI, when administered, showed similar improvement. The findings occurred whether the patient's mood

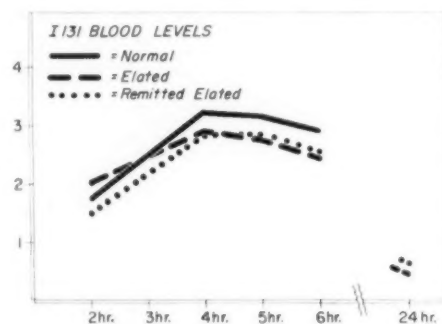


Fig. 2.— I^{131} blood percentage: elated group.

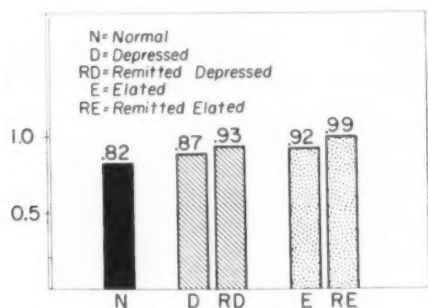


Fig. 3.—Forty-eight hour I^{131} fecal percentage.

changed by spontaneous remission, with group milieu activity and psychotherapy, with electric convulsive therapy (14 depressed patients and 5 manic patients), or through a tranquilizing drug, perphenazine (Trilafon) (three depressed patients and four manic patients). Intermediate studies in three cases showed no significant alteration of blood or fecal radioactivity while receiving perphenazine. Figure 4 is an example of the I^{131} triolein absorption and mood measurements on a patient when depressed as contrasted with those for his recovery.

Comment

The results of this study clearly show that lipid digestion and absorption were not affected by profound and sustained depression or elation. Since the broad malabsorptive syndromes characteristically exhibit the most striking defects in the absorption of fat,¹⁷ it would appear likely that digestion and absorption of all foods were normal in the patients studied. Indeed, the occasional comment of the depressed patient that he makes himself eat but that it does him no good would appear to be unreliable. These data suggest that the weight loss exhibited by most of these patients was due to inadequate intake, although altered utilization of absorbed lipids as a contributing factor was not ruled out by this study.

Previous studies^{12,13} have indicated that slight to moderate delay in gastric emptying was not accompanied by significant altera-

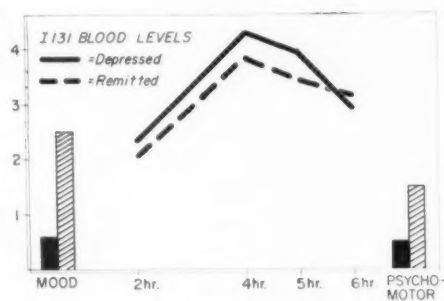


Fig. 4.— I^{131} blood levels for depressed patient.

tions in blood radioactivity in normal subjects given I^{131} -labeled triolein. However, high-grade obstruction in man given I^{131} -tagged triglyceride results in marked lowering of blood radioactivity,¹⁸ and complete pyloric obstruction in the dog yields an insignificant value.¹² The similar blood concentrations in our subjects, whether normal, depressed, or elated, suggests that there was not gross alteration in gastric motility or emptying.

The presence of concurrent gastrointestinal complaints or structural gastrointestinal disease may be overlooked or difficult to evaluate in middle-aged depressed patients. The results of this study suggest that the I^{131} -labeled triolein absorption test is a worth-while diagnostic procedure to help in distinguishing such patients from those with pancreatic or small-intestinal disease.⁸⁻¹⁰

Conclusions

Lipid digestion and absorption are not affected by a sustained depression or elation of mood. In addition, gastric emptying would appear not to be grossly altered in such patients. The I^{131} -labeled triolein test may be useful in the evaluation of concurrent gastrointestinal symptoms in depressed patients.

Charles D. Spielberger, Ph.D., advised in use of psychological measures, and B. H. McCraw, M.A., facilitated the radioisotope measurements.

Psychiatric Service, Veterans Administration Hospital, Fulton St. and Erwin Rd.

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Prediction of Improvement by Use of Epinephrine-Methacholine (Meecholy) Test

Study of Immediate Response in Twenty-Six Treated Patients and One-Year Follow-Up of Forty-Eight Treated Patients

JAMES H. SATTERFIELD, M.D., St. Louis

Introduction

There has long been a search for a physiological test which would predict response to therapy in psychiatric disease. Gold,¹ in 1943, and, later, Funkenstein²⁻⁷ described such a test. The test as usually described consists of following the blood pressure response to either epinephrine and methacholine (Meecholy), given at different times, preferably on different days, or to methacholine alone. On the basis of the blood pressure response to these drugs, patients may be divided into two categories: those with favorable and those with unfavorable prognosis.

Because of the importance of having a physiological test of predictive value, I decided to extend the studies thus far reported by repeating the original ones and by a long-term study, which, as far as I know, is the first such investigation reported.

Procedure and Results

Attempt at Confirmation of the Epinephrine-Methacholine Test

In an effort to evaluate the autonomic test described by Funkenstein, two populations were studied. The first consisted of 44 psychiatric patients admitted to Malcolm A. Bliss Hospital. Information for this study was obtained from the

Submitted for publication Aug. 18, 1958.

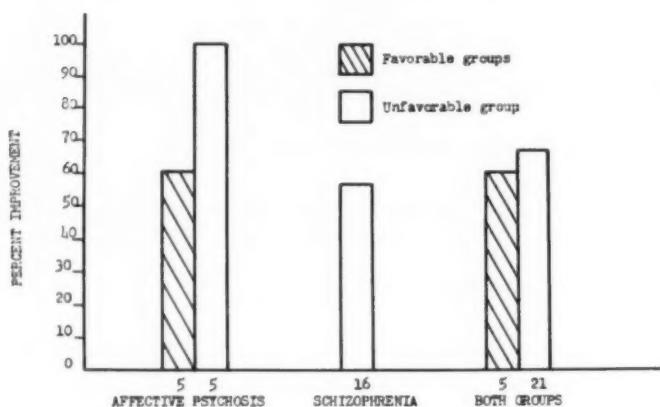
From the Department of Psychiatry and Neurology, Washington University School of Medicine, and Research Laboratories of Malcolm A. Bliss Mental Health Center.

In this series, 10 patients were followed for two years, 20 patients for one year, and 18 patients for six months, giving a mean follow-up period for all 48 patients of approximately one year.

patients' hospital and laboratory records, and the patients were not seen by me. Most of the previously published data correlates test results with responses of the psychotic patients to electroconvulsive therapy. Therefore, psychotic patients were selected for this study on the basis that they were to receive electroconvulsive or photoshock therapy. Selection of patients for this type of treatment was made by the clinical staff physician, entirely independently of the group carrying out the testing. The decision to treat the patient by ECT or PST was made prior to the testing and was not altered by results of the test. Not all patients who received ECT or PST were tested, because of the limitations of time and personnel. The selection of the group of patients for testing from the larger group that was to receive ECT or PST was, so far as I know, a random one. Of these 44 patients, 12 were dropped from this study for one or more of the following reasons: 1. The patient signed out, against medical advice, before completion of treatment. 2. Length of hospitalization following completion of treatment, which is used in this study as a criterion of improvement, was prolonged by fractures or other medical complications. 3. Interval between last treatment and time of discharge from the hospital could not be clearly ascertained from the hospital record. 4. A diagnosis other than schizophrenia, manic-depressive reaction, depressed type, involutional psychotic reaction, or psychotic depressive reaction was made.

Prior to treatment the autonomic test was done, as described by Funkenstein.⁶ Both drugs were administered on the same day, epinephrine being given first. One report⁸ in the literature indicates that when the drugs are given in this order and on the same day, the test-retest reliability may be reduced. Of the remaining 32 patients, 4 patients had anxiety either precipitated or relieved by methacholine, and two patients had a chill following administration of methacholine. On the basis of the epinephrine-methacholine test, the four patients with anxiety were predicted to give a poor response, and the two patients who had a chill were predicted to give a good response. However, Funkenstein^{2,8}

Percentages of patients improved in the favorable and unfavorable autonomic groups. The numbers along the bottom of the graph indicate the number of patients in each group.



has indicated that anxiety precipitated or relieved by methacholine or a chill following methacholine is a good prognostic sign, and both patients with a chill and three of the four patients with anxiety following methacholine administration did, in fact, improve after therapy. Because of the special prognostic significance of anxiety or chill, these six patients were considered separately and were not used in evaluation of the test. The remaining 26 patients were divided into two groups, as described by Funkenstein⁹ on the basis of whether the blood pressure following methacholine injection returned to preinjection level within the 25-minute observation period. Those whose blood pressure returned to the preinjection level were considered as having an unfavorable prognosis. Those patients whose blood pressure did not return to the preinjection level were designated as having a favorable prognosis. The single criterion of improvement used in this study was duration of hospitalization following completion of treatment. The patients were considered improved if they were well enough to leave the hospital within 40 days after completion of treatment. Those who had to remain in the hospital for longer periods following treatment, or who were transferred to a state hospital, were considered not improved. It was felt that the type of treatment was not a factor that had to be considered, because PST⁸ has been shown to be equally as efficacious as ECT and because Funkenstein⁹ states that the autonomic grouping predicts clinical response regardless of therapy used.

Results

The results of this study can be seen in the accompanying Figure. Among the affective psychoses (psychotic depressive reaction, involutional psychosis, and manic-depressive reaction, depressed type) the improvement rate of those patients who

were predicted to improve on the basis of the epinephrine-methacholine test was 60%. The improvement rate of those patients who were predicted *not* to improve was 100%. Although the differences in the improvement rates of the two groups is not statistically significant, owing to the small number of patients, there is a trend for the patients with the poor prognosis to do better.

On the basis of this test none of the schizophrenics were predicted to improve. However, the improvement rate for this group was 56%. When both the schizophrenic patients and the patients with affective psychoses are considered together, the improvement rate for the group predicted to improve on the basis of the epinephrine-methacholine test was 60%, and the improvement rate for the *poor* prognostic group was 67%. There is, again, a trend for the group with the *poor* prognosis to do better, but this is only a trend, and is not statistically significant.

Long-Term Follow-Up Study

A search of the literature reveals no long-term follow-up studies of patients with a favorable prognosis as compared with those with an unfavorable prognosis on the basis of autonomic tests. It was felt that a long-term follow-up study would be more meaningful than the immediate response to therapy, which other investigators and I

EPINEPHRINE-METHACHOLINE TEST

have used. The subjects in this long-term study were all patients who had been given the methacholine test at the office of a private psychiatrist. These patients were selected for methacholine testing from a larger group of patients coming to the office on the basis of their appearing either anxious or depressed. Those patients who had received tests less than six months before were arbitrarily eliminated, leaving a group of 48 patients who were the basis of this study.

The test was done as described by Funkenstein,⁷ except that the epinephrine testing was omitted. The patients were divided into two groups: those with the favorable prognosis and those with the unfavorable prognosis, using the same criterion as that described by Funkenstein⁶ and as that employed in our short-term study, reported here. The amount of treatment received was used as a measure of how sick the patients were in each of the two groups. The more treatments received, the sicker the patients were considered to be. The treatment factors measured for the two groups were number of patients requiring outpatient ECT, number of patients requiring one or more hospitalizations, and average number of office visits per patient. Of the 24 patients in the favorable prognostic group, 13, or 54%, required subsequent hospitalization one or more times; and 8, or 33%, required outpatient ECT, and they averaged 8.3 office visits per patient during the follow-up period. In the unfavorable prognostic group, 12, or 50%, required one or more hospitalizations; and 9, or 42%, required outpatient ECT, and they averaged 7.4 office visits per patient during the follow-up period. At the 0.02 level of confidence there is no significant difference in the two groups in regard to hospitalizations, office visits, and outpatient ECT. This suggests that the criteria suggested by Funkenstein do not differentiate those patients with good prognosis from those with poor prognosis in a long-term study, and it did not differentiate them in our acute study.

Satterfield

Conclusions

The data of the present studies support the following conclusions:

1. In the first study reported here, the two groups, with favorable and with unfavorable prognoses, as defined by Funkenstein, show no significant difference in immediate response to therapy.

2. In the second study, six-month to two-year follow-up studies of the two groups, with favorable and unfavorable prognoses, as defined by criteria suggested by Funkenstein, show no difference in response to therapy.

3. In two different populations, the first a group of hospitalized psychotic patients, and the second a group of nonhospitalized patients coming to the office of a private psychiatrist, the epinephrine-methacholine test did not differentiate those patients with good prognosis from those with poor prognosis.

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Transference-Countertransference Phenomena in Choice of Shock

Review of One Hundred Eight Cases, with a Comparative Study

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Although electroshock is a useful treatment, we are not uniform in our thinking about it, and are often in doubt as to when and how to employ it. While certain criteria for its use have been established with respect to diagnosis, symptomatology, and chronicity, it remains difficult to predict accurately the response of any individual patient to it. This state of affairs may well be traceable to our failure to consider, in the design of studies bearing on the effectiveness of EST, the host of variables pertaining to the patient, the therapist recommending and administering EST, and the relationship of the doctor and the patient.

Over the past 15 years many workers experienced in the use of the somatic therapies have been impressed with the influence of factors other than the three enumerated above on the effectiveness of EST in any given case. These factors broadly fall into two categories: those relating to the total make-up of the patient, and those inherent in the treatment situation itself, including the quality of rapport established before and during the period in which EST is being administered.

With respect to the patient himself, recent attention has been given to such factors as basic character structure,¹⁻⁵ the degree of reaction on the part of the patient to

his own illness,³ and the nature of the patient's resistances.^{6,7}

With regard to the treatment situation itself, Gralnick,⁸ on the basis of an intensive study of the effectiveness of insulin treatment at Central Islip State Hospital, suggested that the specific value of insulin lay in its setting the stage for a very special type of interpersonal relationship. He conjectured that another drug which produced deep sleep for a few hours without lowering the blood sugar level and which would permit the same treatment procedure as that associated with insulin administration would produce equally good results. Controlled studies have borne this out for insulin⁹ and ECT as well,¹⁰ indicating the need for closer scrutiny of the psychologically therapeutic effects of the somatic therapies. Important recent studies in this area have been made by Bogen-Tietz¹¹ and by the Henry Phipps Clinic under Whitehorn,¹² stressing the importance of the therapist's active participation in an anaclitic role to the patient receiving EST.

The quality of the relationship established between doctor and patient, in which context the choice of EST is determined, has also received attention recently. Investigations conducted by Hollingshead and Redlich^{13,17} have indicated that when diagnosis is held constant, somatic therapy is given more commonly among the lower social classes. Workers at Hillside Hospital¹⁸ have reported that patients who differ most strikingly from their therapists with respect to cultural background are most likely to receive electroshock therapy, apparently on the

Submitted for publication Aug. 18, 1958.

High Point Hospital.

Funds for this study have been provided by the U. S. Public Health Service, Grant No. M2349.

Dr. J. William Silverberg and Dr. Guy E. Leduc assisted in culling data from the records studied.

Read in abbreviated form at the 114th Annual Meeting of the American Psychiatric Association, San Francisco, May 16, 1958.

basis of defective communicative interaction between patient and therapist.

Factors such as these are not usually considered as influencing the decision to employ shock. Yet if they are generally operative, albeit inadvertently, we are not giving EST entirely for the reasons we think we are. Since the effectiveness of any treatment can be judged only in relation to the reason for which it is used, the final evaluation of the efficacy of EST must await the full elucidation of all the factors bearing on the decision to use it in any given case. The present study was undertaken toward the end of identifying additional factors, recognized and unrecognized, influencing the decision to use EST.

Clinical Material Studied

This study was conducted in a 40-bed private psychiatric hospital, where each patient receives three to five hours of psychoanalytically oriented psychotherapy per week, regardless of whether EST is concurrently employed. Each patient receives a highly individualized program of treatment and management. Shock treatment is used as an adjunctive procedure, and only to the degree that it will bring a patient into sufficient contact with reality to establish a meaningful relationship with his therapist. It is not used with any predetermined idea as to number or frequency of treatments, though grand mal seizures are sought.

The decision to give shock is in all cases made by the medical staff as a group and therefore is subject to the staff doctors' individual biases toward that modality of treatment. The structure of the hospital is such that all members of the staff involved in these decisions have intimate daily contact with all the patients, including occasional interviews of them. Where differences arise among the staff as to whether proper indications exist for the addition of EST to a patient's program, the therapist's opinion is given major consideration; but the decision is made by majority vote.

The material of this study consists of the clinical records of 58 patients receiving EST plus psychotherapy and 50 patients receiving psychotherapy alone. Patients were randomly selected from among the hospital admissions of the last three years. These records contain detailed progress notes on the clinical course of the patient. Patients given shock received from 1 to 20 treatments, one-half receiving 6 treatments or less.

Method

The shock and control groups were compared with respect to diagnosis, presenting symptoms, age, duration of illness, and personality traits affecting the doctor-patient relationship, in an attempt to isolate factors responsible for patients falling into the shock rather than the nonshock group. The data compared with respect to diagnosis, symptomatology, years ill on admission, and age require no further explanation. Personality traits were classed as tension-producing or not in relation to their impact on the doctor-patient relationship.

The following traits, attitudes, and behavioral qualities were considered likely to produce transference-countertransference tensions: clinging, pleading, excessively dependent, demanding, and controlling behavior; manipulative tendencies; negativistic or nihilistic disposition toward therapy, and openly hostile attitudes to the therapist. The justification for assuming that these characteristics were apt to lead to doctor-patient tensions lay in our clinical knowledge of what transpired under such conditions. We had observed that they regularly produced deficiencies in rapport, the extent of which varied with their degree and the sensitivity of the therapist to them. We had often seen pleading, excessively dependent patients lose faith in the therapist who could not quickly satisfy their pleas or demands for relief. Analytic modification of these traits could not proceed well under such conditions. We had experienced discomfort in working with such patients and felt certain that this communicated itself to the patient, further impairing rapport.

In our study, then, patients were categorized as having traits impairing rapport on the basis of the multiple mention of one or more of them in the doctors' notes.

Data

The results of this comparative study are given in the accompanying Tables.

TABLE 1.—*Diagnosis*

	Shock Group (58 Cases), %	Nonshock Group (50 Cases), %
Schizophrenic reactions	64	76
Paranoid type	36.4	50
Undifferentiated	24.2	20
Catatonic	3.4	4.0
Hebephrenic	0.0	2.0
Involutional psychoses	17.3	2.0
Manic-depressive psychoses	5.2	4.0
Psychotic depression	1.7	4.0
Organic psychoses	5.2	4.0
Psychoneuroses	6.9	10.0
Total psychoses	87.1	90.0

TRANSFERENCE-COUNTERTRANSFERENCE PHENOMENA

The groups were found to be comparable with respect to the frequency with which a psychosis was diagnosed, 87% of the shock group carrying such a diagnosis, while 90% of the control group was considered psychotic. The somewhat greater incidence of schizophrenias in the control group (76%, as compared with 64%), was offset by the heavier representation in the shock group of involuntional psychoses (17% as compared with 2%). Thus diagnosis correlated significantly with choice of shock only in the involuntional group, but was not a factor in the other diagnostic groups comprising the great bulk of the material studied.

TABLE 2.—Symptoms

	Shock Group	Control
Depression.....	32	32
Suicidal trends.....	13	15
Overactivity.....	3	2
Delusions.....	17	15
Agitation.....	14	14
Withdrawal.....	4	10
Poor controls.....	1	0
Uncooperative attitude.....	7	0
Panic.....	1	0
Aggressive behavior.....	1	4
Disturbed nonaggressive behavior.....	7	4
Nihilistic ideas.....	3	0
Hallucinations.....	2	3
Confusion.....	4	7
Apathy.....	2	1
Unrealistic thinking.....	1	0
Autism.....	1	2

A comparison of the presenting symptoms of the two groups surprisingly revealed no significant differences in any of the following conventional indications for EST: depression, suicidal trends, overactivity, disturbed or destructive behavior, delusions, hallucinations, confusion, withdrawal, or autism.

However, statistically significant differences did occur when the age and duration of illness in the two groups were compared, the shock group being skewed in the direction of older patients whose illness had been of shorter duration.

With respect to tension-producing traits, it seems striking that 63% of the shock

TABLE 3.—Duration of Illness on Admission

	Shock	Nonshock
6 mo.....	31	16
6 mo. or more.....	27	34
	$\chi^2=4.34$	
	$P=0.0256$	

group manifested one or more such traits, as against 30% of the nonshock group. It was also of interest that of the 15 control patients who were considered for, but not given, shock, generally because of physical contraindications, 12 showed tension-producing traits. In general, three factors were most highly correlated with the selection of particular patients for shock treatment. These factors, namely, age, recency of onset of illness, and presence of tension-producing traits, each predicted shock at a statistically

TABLE 4.—Age

	Shock	Nonshock
40 or over.....	30	14
40.....	28	36
	$\chi^2=5.32$	
	$P=0.0139$	

significant level of confidence, whereas diagnosis and symptomatology did not. This remained equally true when the involuntional patients were excluded and when schizophrenic patients alone were considered.

Based on χ^2 -test determinations and Fisher's exact probability test, the presence of tension-producing traits correlated most highly with the appearance of a patient in the shock group and statistically, therefore, is the most accurate predictor of shock in this series of cases.

Clinically, as well as statistically, there is reason to believe that the tension-producing

TABLE 5.—Personality Traits

	Shock	Nonshock
Presence of tension-producing traits.....	37	16
Absence of tension-producing traits.....	21	34
	$\chi^2=8.01$	
	$P=0.00135$	

traits might be the most significant of the three factors in determining choice of shock.

The age difference in the two groups was a matter of less than five years above or below the age of 40. On this account, it did not seem probable clinically that whether a patient was 35 or 45 would determine his selection for shock. Likewise, with respect to the "duration of illness" factor, we at our hospital generally view recency of onset as an indication for psychotherapy, rather than shock.

On the other hand, we had often observed situations in which the staff was in full agreement that indications for shock were or were not present, but the patient's therapist would disagree with the group in its decision to give or not give shock treatment. This suggested that the therapist was responding to something in the psychotherapeutic situation which he was either unaware of or unable or reluctant to communicate to the others. The presence of countertransference tensions might well account for this discrepancy of opinion.

We next attempted to study further the tension-producing group to see whether their disturbing traits appeared independently or in association with the factors of diagnosis, symptomatology, age, or duration of illness. If these traits were only a dependent variable, the factors with which they appeared might really be the determining ones in the choice of shock.

A comparative study was made only of the patients manifesting these traits; this involved 37 patients receiving shock and 16 not receiving shock. We found that in all age groups tension-producing traits are two to four times as prevalent in the shock as in the nonshock group. Further, this is equally true whether the illness is of more or less than six months' duration. No new differences appeared except for one. Of patients with these traits who received shock, 54% manifested agitation more frequently, as opposed to 25% of the nonshock group. Conceivably, this is so because agitation places a further strain on the doctor-patient relationship, makes more prominent the pa-

tient's tension-producing traits, and confronts the therapist with the need to produce relief more rapidly.

Of the 58 cases receiving shock, of which 37 manifested these tension-producing traits, in only 2 were rapport difficulties specifically cited in the record as playing a role in the choice of shock treatment. In the other 35 instances, the therapist was either unaware of the significance of these traits in his choice of treatment or felt constrained not to indicate the role they played. Yet many of the other 35 records lent themselves to the inference that transference-countertransference tensions were operative.

Comment

We are mindful of the fact that we are applying statistical methods to complex phenomena which are difficult to identify with certainty. However, the application to psychiatric phenomena of improved research designs, such as the double-blind study, has focused attention on the importance of the doctor-patient relationship in any treatment procedure. Currently in most instances choice of shock treatment is determined by the rather classical indications, such as diagnosis, symptomatology, recency of onset, and psychotherapeutic inaccessibility. Apparently, however, more subtle human factors may be of importance in the selection of treatment. Our study would seem to suggest that the first three indications are not necessarily as significant as had been thought, and that the fourth indication warrants more detailed study. It would seem reasonable, as this study suggests, that there are aspects of the patient-therapist relationship which influence, albeit inadvertently, the selection of shock treatment for a patient, perhaps as much as anything else.

Although ordinarily considered obscure, it would seem that such subtle human factors as tension-producing traits can be studied with some degree of accuracy. Perhaps our future studies, as well as those of others, will suggest leads for improved methods of defining and quantifying the

complex factors inherent in all psychiatrist-patient relationships. It is to be hoped that shock treatment will not be completely abandoned because of our enthusiasm for the new drugs before such studies can be thoroughly done.

The objection might be voiced that our findings are specific to High Point Hospital, and otherwise inapplicable. However, it may also be that it is because of the very nature of our program that we are able to discern and validate these findings. Consequently, there is room to believe they are applicable wherever psychiatrist and patient meet in a treatment situation, whether the doctor is aware of these influences on him or not.

Summary

The clinical records of 58 patients receiving electroshock and psychotherapy were compared with those of 50 patients receiving psychotherapy alone. Comparative figures in the two groups were obtained for diagnosis, symptomatology, duration of illness, and tension-producing traits with respect to the doctor-patient relationship.

Neither diagnosis nor symptomatology predicted the choice of shock in the cases studied. Recency of onset, age, and the presence of tension-producing traits with respect to rapport, each predicted shock at a statistically significant level, the last being the most accurate predictor.

Attention is called to the need for further study of the subtle human factors that may operate in the selection of shock treatment for any given patient.

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Books

BOOK REVIEWS

The Psychiatric Hospital as a Small Society. By William Caudill. Price, \$6.50. Pp. 412. Harvard University Press, 79 Garden St., Cambridge, Mass., 1958.

The hospital of which Caudill writes is the Yale Psychiatric Institute. Caudill was brought there in 1949 by Redlich, who, in his interesting foreword to this volume, enumerates reasons why it is unlikely that an anthropologist will again collect data under the guise of being himself a patient. But Caudill has again employed the effective method known as field work, including, this time, quantification of certain of his data, plus a TAT-type of picture-interview.

Unlike the field-work study done by Stanton and Schwartz, Caudill reports upon an entire hospital rather than a single ward. The impact of his study has long since been felt in the Yale Hospital, according to Redlich, who also comments that "there is no doubt in my mind that psychiatrists and clinical psychologists, psychiatric social workers, psychiatric nurses, and other ward personnel have much to learn from such a social scientist" working in the hospital along with the more usual staff personnel.

Redlich's comment is a key to Caudill's book. The book is not simply a report of work done within and upon a hospital: it represents one more effort by a social scientist to demonstrate the usefulness of his professional training and craft for understanding what goes on inside the psychiatric hospital—even for what goes on in the treatment of psychiatric patients. In a broader sense, Caudill is concerned with demonstrating—presumably to psychiatrists, since anthropologists and sociologists would generally grant his point—that the hospital "is a small society, and that the on-going functioning of such a society affects the behavior of the people who make it up in many ways of which they are unaware." The hospital must be understood "as a complex system of interaction . . . before it will be possible to utilize fully the potentialities of the hospital as a therapeutic community."

The intent of his study then is announced clearly, and early in the volume. Then, at the very close of the book, in the last chapter, Caudill argues eloquently for the possibility of a "clinical anthropology." What he suggests there is a full-time social scientist who would function within the hospital as an over-all observer; but who would communicate his observations and suggestions during regular staff meetings and conferences, thus building into the hospital his special capacities for study and observation.

The book, therefore, is an open attempt to demonstrate to the psychiatric profession something of how the special studies of anthropologists can contribute to psychiatric knowledge. (I say "psychiatric knowledge" with full awareness, meaning something more than what goes on in the therapy session between patient and psychiatrist.) How well Caudill has attained that end can only be judged after a sufficient number of psychiatrists have read the book and either acted upon it or rejected its central conclusion.

The research report itself falls into three parts. The first is based upon daily observations at all levels of staff function, and also upon observations of patients. Redlich apparently found the first chapter in this section particularly enlightening; in it Caudill describes the influence of the hospital itself upon the course of a doctor-patient relationship. I found the chapter dealing with collective disturbances especially interesting; here Caudill succeeds in describing the rise and fall of such a disturbance in considerable detail. The second section is based upon picture-interviews. A fair amount of the material gathered through the interviews is then quantified, but the interviews themselves (a number are printed) are extremely interesting in themselves. Various observations by Caudill are scattered throughout these chapters, and these should find a ready response among his readers. ("The patients were frequently in real contact with more situations during the course of the day than was any other group" and "the seniors were simply unacquainted with the details of the physical makeup of the hospital. This was similar to . . . the nurses. . . . A nurse working on the open ward would not have any real knowledge of what it was like on the locked ward" [pp. 166 and 180]). Each reader can make for himself similar comments and inferences on the basis of the published picture-interviews. A third section of the book reports "A Small

BOOKS

Group Analysis" of administrative processes in the hospital. The data comes from minutely recorded verbal and nonverbal interactions occurring at sixty-three consecutive administrative conferences, held daily. This material also is handled quantitatively.

I suspect that social scientists themselves will be somewhat disappointed in the book. It does show the hospital, and very well, as an elaborate social structure. It does contain some very rich materials, some fine observations, and interesting analyses. What it fails to do is more systematically to develop concepts for picturing and analyzing the hospital as a social structure. (There are attempts at concept development, as in the chapter dealing with collective disturbances, and here and there in other chapters.) In fact, the book really gives a much better picture of the different perspectives and different blindnesses of various personnel than it does of the structure of the hospital as such. We are not even offered a very clear picture of exactly who the patients and who the staff are, or of the cultural backgrounds they bring to the institution. But I trust that neither psychiatrists nor social scientists will take this criticism as a warning not to read this book. It is a good and useful book. For anyone interested in psychiatric hospitals—for anyone interested in medical practice carried on within psychiatric hospitals—the book is a "must."

ANSELM STRAUSS, Ph.D.

Psychological Stress: (Psychoanalytic and Behavioral Studies of Surgical Patients.

By Irving L. Janis. Price, \$6.50. Pp. 439. John Wiley & Sons, Inc., 440 Fourth Ave., New York, 1958.

This impressive book deals with a relatively neglected subject which is of importance from the point of view both of its theoretical significance for the behavioral sciences and of its practical implications for alleviating the emotional suffering attendant upon physical suffering. While the book reports the results of research on the psychological reactions of surgical patients, the author approaches his subject matter with some years of experience in disaster research and laboratory studies of stress behind him, and places the subject sturdily within a general theoretical perspective of stress as a universal human experience. The author's propositions, thus, are couched in abstract terms applicable to generalization to other stress situations. Although specific descriptive material, and practical suggestions for preparing surgical patients, are included in the text, the author clearly is most concerned with making a contribution to a general theory of stress behavior.

In addition to the ambitiousness of the author's scope of inquiry, the reader is immediately struck by the several different types of data which Janis has amassed. A psychoanalytically trained psychologist, Janis was seeing a patient in analysis when it was necessary for her to undergo a surgical operation. Detailed descriptive records of the analytic sessions were kept, which allowed for later scrutiny of the patient's responses to the surgical experience as they were manifested in the analytic hours preceding and following the operation. Janis reports these sessions in considerable detail, interposing the narrative record with interpretative chapters, in which he sets forth generalized hypotheses concerning the psychodynamics of his patient's reactions. Second, Janis carried out a series of intensive case studies of patients on a surgical ward. He subjected the patients to intensive, semistructured interviews both prior to their operations and some days following the operations. In addition, he collected the medical and nursing notes bearing on the behavior of his patients. Altogether, he had complete protocols on 22 patients. Last, Janis administered a questionnaire to a mass of Yale undergraduates concerning their reactions to any surgical procedures within their recent experience, a procedure which left him an effective survey sample of 149 cases.

Undoubtedly, the differing requirements of effective presentation account for the fact that the analytic case study takes up a good half of the book, while the survey results are covered in less than a quarter of the remaining half. Nonetheless, the allocation of printed space reflects, I think, the relative care and intensiveness with which the author has carried out the different types of analysis, as well as the importance and limitations he attributes to the methods. But the most important issue here is not the relative merits of these methods, nor the competence of their execution, but how well they go together, whether they interlock into a well-rounded picture. The analytic method, intensive behavioral case study, and survey analysis simply cannot answer the same questions. They slice the pie at different levels. In that sense they are not strictly comparable, and a researcher cannot directly test a hypothesis derived by one of these methods with evidence from another methodology. What

seems to be necessary is to carefully fit together a structure of propositions in which each method is utilized to contribute a different kind of answer, the whole of which has plausibility. The methodology of interdisciplinary research, which is what Janis was doing, is in need of a great deal of thought. As it is, the sections of Janis' work are loosely hung together. The analytic and case study material are utilized effectively to do what they can best do. He does set them to answering a different order of questions. But what relationship they might have to one another is not spelled out. The survey findings, on the other hand, are used rather crudely to bolster the generality of some of the case study propositions, rather than exploited in their own right. These statements are meant not as criticism of Janis but to point out some consequences of using different methodologies without working through their interrelationships, if any.

For purposes of summary, Janis' analysis of the psychoanalytic material consists of elaborating a set of propositions based upon the notion of *reactivation*. The assumption is that the experience of stress tends to reactivate ordinarily repressed material; the threat of bodily danger tends to be unconsciously assimilated to various childhood experiences of deprivation. The person's present organization of perceptions and responses, thus, tends to break down, and more primitive responses take over. This approach expects personality disorganization as a more or less "natural" reaction to stress. The crucial word is *tends*, though. It is to Janis' credit that he attempts to pin this down through a detailed discussion of the specific personality predispositions of his patient which, in conjunction with the particular situation of stress, led to her downfall. Some persons show this tendency more than others.

It is a wonderful comment on the requirements of methodology that in the very next section Janis finds himself arguing from a diametrically opposite point of view. Here his initial hypotheses posit a relationship between the degree of fear experienced preoperatively and the postoperative emotional reactions. Persons displaying an inordinately low or high degree of fear are those who have the greatest difficulty postoperatively. The more usual reaction is not disorganization at all, and his argument places the causal nexus not in a person's genetic development but in the immediately prior set which he brings into the situation. Indeed, he argues against personality predisposition as a too easy explanation for a number of his cases.

It is in following up on these propositions that Janis, in my view, makes his real contribution. He develops the notion of *psychological preparation*, and an additional concept, the *work of worrying*. He hypothesizes that a certain amount of worrying is necessary in order to meet the stressful situation with a minimum of disturbance. Janis explains the function of worrying as providing the person with a more realistic set of self-directed reassurances, which protect him from being overwhelmed by unexpected and frightening events.

The question can be raised whether psychoanalytic case material is appropriate for testing these hypotheses concerning reactivation of ordinarily repressed material. Janis' patient did indeed experience recall of early childhood episodes in connection with her surgery, but one cannot be confident that this response to the surgical stress was not a function of the fact that she was an analytic patient, and had been such for over a year. Presumably, analysis coaches a patient into a mode of continual self-scrutiny which places emphasis on reactivating childhood experience. Such a patient may encounter all experience in this fashion. Thus, observations on a person so involved in the analytic process might always seem to corroborate reactivation hypotheses.

One last word of caution. Although Janis' interest in developing a general theory of stress behavior is quite laudable, the readiness to abstract features has certain drawbacks. Janis' psychoanalytic orientation predisposes him to focus on the experience of affect. Fear is fear, and aggression is aggression, regardless of situation. And it is true that certain sequences of emotional response seem repetitions from one stress situation to another. Nonetheless, surgery is a very different experience from a community disaster. Not only is the experience of the victims different, but, more important, the conditions giving rise to similar reactions are highly disparate. Thus, it is necessary to ask not only how surgery is similar to other stress situations but how it differs. Frequently, inquiry into the conditions which distinguish situations will result in a whole new set of fruitful questions.

RUE BUCHER.

Ego Psychology and the Problem of Adaptation. By Heinz Hartmann, translated by David Rapaport. Monograph Series No. 1, *Journal of the American Psychoanalytic Association*. Price, \$3.00. Pp. 121. International Universities Press, Inc., 227 W. 13th St., New York 11, 1958.

This book is an English translation of material presented in 1937 before the Vienna Psychoanalytic Society and then published in German in 1939 in a psychoanalytic periodical. In the year 1958 Dr. Hartmann was presented the Charles Frederick Menninger Award for the impact of this book on psychoanalytic theory and method through the intervening years. Apparently, the publication of the book today in an English translation is motivated by the desire to make available the first formal consideration of ego psychology in the psychoanalytic field and the beginnings of a new direction in psychoanalysis. However, Hartmann's publications in the subsequent twenty years, along with those of his colleagues, have amplified and advanced the field of ego psychology far beyond what is in this initial work.

There is a serious defect in this book for which the editorial board of the *Journal of the American Psychoanalytic Association* should be held responsible. The English translation is atrocious. It contains more parentheses, dashes, and un-understandable phrases than this reviewer has ever read in a translation. The difference between adequate English and this literal translation can be observed by contrasting the preface written by the editors with the body of the book. The original author, Dr. Hartmann, who has been in this country now at least twenty years, can himself write better English than is represented by the translation. Perhaps the infelicity of the translation may be demonstrated by the following quotation: "A theory which takes one aspect of rationality and relativizes it in relation to the irrational, in order to attribute to another aspect of it the dominant role in mental life, implies two major dangers: on the one hand, the rationality of knowing may lead to a disregard of the significance of the irrational, and also to a failure to recognize the irrationality of the goals; on the other hand, reason may capitulate to irrationality. The latter is, in and of itself, the greatest danger though not for the psychoanalyst."

Hartmann contends that psychoanalysis is now a general theory of mental life and, although it encompasses some of the subject matter concerning which psychology has made countless investigations, it is not the subject matter but the scientific methodology and the structure of the concepts it uses that distinguish psychoanalysis. This is an attempt to counteract the criticism that academic psychology has been concerned with studying ego functions long before psychoanalysis. On the other hand, Hartmann states that recent developments in psychoanalysis have not changed its salient characteristics, namely, its biological orientation; its genetic, dynamic, economic, and topographical points of view, and the explanatory nature of its concepts. This dismisses the notion that, when psychoanalysis and nonanalytic psychology study the same subject matter, they will of necessity arrive at similar conclusions. Then the author brings in a fortuitous statement which is quite disturbing. He says: "Even though Freud rightly declined to regard psychoanalysis as a system, it is nevertheless a cohesive organization of propositions, and any attempt to isolate parts of it not only destroys its overall unity, but also changes and invalidates its parts." Do not touch, says Hartmann.

After dismissing the efforts of nonanalytic psychology over many decades as not being significant, the author then proposes that the term *conflict-free ego sphere* be provisionally applied for the functions which at any time exert their effects outside the region of mental conflicts.

What does this mean? It means that ego is not entirely derived from a conflict of the instincts and the external world but is a potential function which is present at birth and for which Hartmann applies the term *apparatus*. Here is a quotation which indicates this point of view: "Learning to think and learning in general are independent biological functions which exist alongside, and in part independent of, instinctual drives and defenses." This certainly was not new, even in 1937, to academic psychologists.

Unfortunately, the author himself, in the original German edition, does not maintain a straight line of thinking. He deviates from discussions of adaptation to learning, education, value systems, etc., and brings into his arguments considerable data from other disciplines, but reasons that a special point of view derived from psychoanalysis is necessary for a proper consideration of these concepts—for example, "Thus the adaption of the individual and of the species are often but not always incompatible." Certainly the biologists have talked about this concept under the heading of homeostasis for a long, long time.

This is a good book for psychoanalysts and psychologists to study. It reveals the beginning of the dethroning of conflict in psychoanalysis as the total explanation of mental processes. The author gives credence to the notion that in the human mind there is a capacity which he calls an inborn apparatus for thinking and learning which transcends the development of conflict and which he calls the conflict-free sphere of the ego and its primary automatism. The secondary problems arise from conflict which affects these primary automatic functions, which indeed become quite complicated. Hartmann, although giving no explicit credit to the biology and psychology of the day, nevertheless includes their concepts in appropriate places in his conceptual thinking. This has strongly influenced the development of psychoanalysis in the last twenty years, and Hartmann's own work, along with that of his collaborators who are interested in ego functions, has developed an ego psychology that has made psychoanalysis much more scientific than it was before. It is, however, the naivete of assuming that only psychoanalysis has been able to develop these concepts and that one must accept all the psychoanalytic theory, otherwise one jeopardizes the field itself, that is open to criticism. Those who become interested in this field from perusal of the book should certainly follow in chronological order the extremely interesting, erudite, and clearly written works of Hartmann in the English periodicals.

ROY R. GRINKER, M.D.

Mental Symptoms in Temporal Lobe Epilepsy and Temporal Lobe Gliomas, with Special Reference to Laterality of Lesion and the Relationship Between Handedness and Brainedness. By Thorsten Bingley. *Acta psychiatrica et neurologica* (Supp. 120) 33:1, 1958. Pp. XI+151. Ejnar Munksgaards Forlag, Nørregade 6, København, K, 1958.

From Serafimerlazarettet comes this complex study, in which hemispherical dominance is elaborated in greater detail than previously. The conclusion is reached, on the basis of skilled acts and aphasia, that the left hemisphere is dominant in 99% of right-handed patients but that the right hemisphere is dominant in only 50% of left-handed persons. Ninety patients with temporal lobe epilepsy were thoroughly studied and compared with 253 patients with temporal lobe gliomas. By statistical methods the author concludes that certain mental symptoms are independent both of intracranial hypertension and of aphasia, and are not due to reactions to the disorder. A special group of 16 patients harbored benign gliomas, with seizures as the only manifestation. Emotional blunting and flattening of affect were found in eight of nine patients with glioma of the dominant temporal lobe, while only one of seven patients with tumor of the recessive lobe showed similar features.

In the whole series grand mal occurred in 85%, absences in 17%, and psychomotor seizures in 70%. The last were commoner in the nontumor cases, but the others showed no significant difference. Ictal aphasia occurred in 48% of patients with unilateral lesion of the dominant lobe. Of the six left-handed patients, none had ictal aphasia. Speech automatism was higher in nontumor cases and was often accompanied by other automatic behavior. Dreamy states occurred in 32%, more frequently with lesions in the recessive lobe. The commonest ictal emotional state was anxiety. Anger, aggressiveness, depression, and elation were less common.

The author employs the term "ixophrenic syndrome" to describe the personality change found in about a third of the patients. It is characterized by adhesiveness, stickiness, viscosity, and perseveration. Secondary traits include intellectual retardation, circumstantiality, stubbornness, and pedantry. Irritability and dysphoria were common, sometimes with explosiveness of affect and aggressiveness. Some patients were assertive, querulous, suspicious, and hypochondriacal; paranoid trends were noted in 10 patients. Strikingly absent were schizophrenic traits, such as dissociation of thinking, autism, ideas of influence, and systematized delusions. No personality changes were found in a third of the 90 patients.

Psychometric tests, using 24 patients with lesions of the recessive lobe as controls, showed marked reduction in both verbal and nonverbal intellectual functions, most markedly so in cases of tumor. Vocabulary, IQ, and memory for 20 paired associates after one hour suffered extreme reduction not only in tumor cases but also in patients with a focus in the dominant lobe or with bilateral shifting foci.

On the basis of careful study of this large material, Bingley brings greater precision to the problem of the temporal lobe defects. As far as possible, he has rated symptoms and signs as present or absent. This is questionable. Aphasia is relative; so is depression or anxiety, or stickiness. Another investigator studying the same patients might have found many more instances of emotional disturbance. It is a question of yardsticks. The use of patients with foci

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in the recessive lobe is of interest, but one misses controls drawn from an equal or a larger number of nonfocal epileptics. As the author points out, however, there is no method by which emotional and volitional changes can be quantitatively measured, as is the case in intellectual impairment. The monograph is stimulating, nevertheless, especially as regards the attention to handedness and brainedness.

Hospital Treatment of Alcoholism. By Robert S. Wallerstein, M.D., and associates. Price \$5.00. Basic Books, Inc., 59 Fourth Ave., New York 3, 1957.

If one were attempting to discern those trends most important in present-day psychiatry, an increased awareness of the need for systematic and rigorous research based on sound methodological principles would clearly stand out. Particularly within the area of therapy, where strong personal and social pressures for "results" have led to the development of techniques of uncertain value grounded in vague and speculative conceptualization, the need has been acute. Through their own experience, Wallerstein and his associates have become impressed with this need in the treatment of chronic alcoholism. Thus, they embarked on "a systematic and experimental study" of this field. Their book is a report of their research conducted at the Winter Veterans Administration Hospital in Topeka.

In their opening discussion the authors describe the background of the study, indicating the scope of the problem, as well as the confused state of our present knowledge. They present a thoughtful, though far from exhaustive, review of previous research and of the theoretical considerations which provided the framework for their approach. Several assumptions underlying the research are indicated. Alcoholism is viewed as a symptom (rather than a disease entity) occurring in persons who represent the complete range of psychiatric nosology. It is seen as behavior understandable in a dynamic psychological (in their case: psychoanalytic) framework. Therefore response to therapy must be gauged in terms of its effect on total functioning, not merely symptomatic improvement. Treatment is felt to require individual motivation and cooperation which can be augmented. Thus, subjects were required to "volunteer" for hospital treatment of fixed duration. Moreover, the researchers do not fall into the trap of examining specific treatment techniques as though they occurred in a vacuum, nor do they attempt to sterilize the field artificially. Aware of the hospital context in which treatment was offered, they continued their milieu treatment program but attempted to control this factor by observation and by keeping it equivalent for all groups.

The research reported is a comparative study, in 178 alcoholic patients, of four treatment methods: disulfiram (Antabuse), conditioned-reflex treatment, group hypnotherapy, and milieu therapy—the last originally designated as the "control." Four groups of four to six patients, randomly constituted, were treated concurrently. After a period of diagnostic study, specific treatment was begun, all groups remaining hospitalized for 60 to 90 days. Follow-up was obtained over a two-year period through brief hospitalizations, supplemented by written communications. Improvement was rated in terms of social adjustment, subjective feelings of difference, and observed personality changes, in addition to the degree of abstinence. The four modalities are separately considered in parallel succeeding chapters of the book, which present a brief review of previous studies, discussion of the rationale and theoretical implications of the treatment, a description of the patient group, results, and a final discussion. The last explores at length observed relations between treatment responses and personality features, for the authors see in each regimen important psychological implications which can be related to individual psychodynamics.

Antabuse, they consider as a fantasied good object replacing a bad one, and as a powerful and entirely external agent whose administration is accomplished through a repetitive routinized act. Correspondingly, patients with a compulsive organization who ritualized the "Antabuse ceremony" did well, as did dependent patients. But it abetted the avoidance of psychotherapy. Its prolonged and certain action seemed implicated in two of three psychotic episodes developing in borderline patients who could not tolerate the enforced sobriety. Conditioning was conceptualized as "punitive" and "the most threatening of the therapies," and indeed was found to be least successful with aggressive patients, who frequently failed to complete the treatment. Similarly with hypnotherapy, these patients did poorly and were resistant to hypnosis despite the finding "in keeping with our expectations [that] the alcoholics as a group were quite hypnotizable." On the other hand, shy, constricted, passive-dependent patients did well, consonant with the conceptualization of hypnotherapy as providing "an experience of psychic surrender and loss of control." Psychotic and borderline patients, though their initial response was

equally favorable, did poorly after discharge, because "transference ties seemed too tenuous to maintain from the outside." No correlations were noted between treatment effectiveness and personality in the control group.

On several counts, including the gross percentage improved, the Antabuse regimen was most successful. Conditioning proved least so. Figures are reported covering several aspects of effectiveness. But, as the authors themselves spell out in their final chapter ("Conclusions and Implications"), there are sharp limitations imposed by the project design, making figures meaningless. Subjects were male veterans voluntarily hospitalized for treatment, the efficacy of which was specifically in question. Treatment regimens were rigidly administered without individualization on a closed ward with a milieu program. These features severely limit generalization, even as to relative efficacy. Much more serious, though less apparent to the authors, are differences among the groups in several crucial respects, such as the duration of alcoholism. Szondi test data (presented only in summary) seem to confirm the existence of differences, though a plausible alternative is advanced. Further, there were important variations in the milieu.

It has become a commonplace for authors to assert that their research raises more questions than it answers. Unfortunately, this frequently falls short of the truth. Psychiatry suffers from a lack of cogent and clear questions sufficiently refined so that they can be tested. It is in this regard that this research report, despite its limitations, is of value. The authors have done more than suggest important relationships between individual psychological factors and treatment regimens. They have developed these in a useful and specific fashion so that these relationships can be examined, refined, and tested. Certainly, one can ask little more of research in so complex and beclouded an area. This book will be useful for all who are engaged in the study or treatment of alcoholism and will prove of interest to anyone engaged in clinical psychiatric research for its constructive illustration of the problems and possibilities in such research.

DONALD OKEN, M.D.

The Integration of Behavior. Volume III: The Reintegrative Process in a Psychoanalytic Treatment. By Thomas M. French, M.D. Price, \$10.00. Pp. 484. The University of Chicago Press, 58th St. and Ellis Ave., Chicago, 1958.

The author, a distinguished psychoanalytic investigator, has assigned himself the task of writing a five-volume series on the general subject of the integration of behavior. This volume is the third of the series and is probably the most explicit in developing Dr. French's concepts of the psychoanalytic process.

He starts out with the purpose of developing an objective check on intuition and attempts to evaluate intuitive insights systematically. Instead of reasoning from theory, he has devised a method by which the integrative functions can actually be tested while at work by direct analysis of clinical data. Here we have the refreshing aspect of Dr. French's work, as contrasted with that of other analysts. He presents in great detail the raw data from which he makes his conclusions, so that other investigators may agree or disagree after studying the actual material which Dr. French uses. French, more than any other analyst, makes use of concrete clinical data from which to test his conceptual framework.

The question is first raised regarding the patient's transference to the analyst, which is both a source of desire to cooperate and a potent form of resistance. The author asks what really motivates the therapeutic process and enables the analyst to help the patient. Psychoanalysis he considers as reeducation or, in other terms, a corrective emotional experience. Because analysis attempts to help the patient resume an interrupted learning process which has been disturbed because of conflict, it becomes necessary to react to the conflict before it can be corrected. The therapeutic aim, then, is to remobilize the conflict under conditions that make possible a resumption of the learning process. The patient requires first a practical understanding, or what French calls a problem-solving insight which is related to an increase in the span of his integrative field. Too great a need pressure tends to destroy insight, but hope of success in achieving a positive goal is the incentive that makes it possible to carry out a plan in accordance with one's practical understanding. According to French, integrative capacity is based on hope, and here is French's major thesis—that rational behavior is organized around hope.

Hope is disturbed by the persisting dynamic effect of a traumatic memory which is often defended against by maneuvers which avoid reactivating fear of consequences, and, therefore,

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the subject turns away from the disturbing wish and seeks substitute satisfactions elsewhere. The defenses against the integrative functions of the ego which turns the subject away from solving the original conflict is an essential focus of psychoanalytic work. He states quite clearly that defenses protect a patient from disillusionment. Resolution, on the other hand, achieved by learning, involves acceptance of the fact that the underlying infantile wishes can never be fulfilled. Then, after the acceptance of disillusionment, the patient must renounce these wishes and accept in their place real satisfaction in the presence of the same underlying needs.

The conditions essential for renewed learning include the reactivation of the traumatic conflict, at least partially, and an increase in the integrative capacity based on new hopes of possible solutions. Conflict may be mobilized by frustration or by new hope, not all at once but in a series of small steps. Each small step may be considered a focus for analytic work, and it is on this aspect that French concentrates. Too often other authors have attempted to deal with the psychoanalytic process as a totality, without breaking it down into discrete foci which enable the scientific method to be utilized. French, on the other hand, uses the small steps involved in resolution of a traumatic conflict as foci for scientific analysis.

The second section of the book deals with the analysis of psychoanalytic therapy by means of a case report and interpretive comments. This contains the essence of his methodology and the detailed interpretations, which can be clearly understood and checked by other scientists. The third section presents recurring sequences and the therapeutic process; the fourth section, patterns emerging from the past. In the fifth section French returns to the case report and further interpretations. The sixth section deals with the effects of diminishing fear; the seventh section, with impulsive behavior and responsible behavior; the eighth section, with the analyst's interpretations and the patient's insight; the ninth section concerns contributions to the art of psychoanalytic therapy. And, if this were not enough, the terminal section deals with supplementary chapters which augment certain concepts which have been developed throughout the book. There is an adequate index and an excellent bibliography.

One of the achievements that French has made in the presentation of his point of view is the close interlocking with actual clinical data, to which he refers with exact references whenever he makes a concluding statement. Because he takes up the same clinical data from many points of view and works the material over and over again, one, unfortunately, gets the feeling of repetition, and sometimes boredom. Nevertheless, French has developed the techniques of pedagogy which, although difficult for the brilliant student to endure, are suited to the person who needs repetition and constant reference to exemplified material. No student of psychoanalysis who has thoroughly studied French's volumes will fail to learn a great deal about the relationship of theory and interpretation to the practical problems of his patients. It is time-consuming to work through French's writings and sometimes quite disturbing because of one's natural impatience to move on. However, there is no substitute for careful and repetitive analysis of clinical data. French is now an accepted leader in psychoanalytic research, and in the reviewer's opinion has done more for the understanding of the psychoanalytic process than any other investigator in the field. This book is highly recommended to all analysts, students of analysis, and psychiatrists.

ROY R. GRINKER, M.D.

Physical Dynamics of Character Structure: Bodily Form and Movement in Analytic Theory. By Alexander Lowen, M.D. Price, \$7.75. Pp. 368. Grune & Stratton, Inc., 381 Fourth Ave., New York 16, 1958.

In addition to the main current of psychoanalysis and the most popular divagations from it, backwaters and eddies exist in which development has been going on in ways quite different from one's habitual conceptual set. Alexander Lowen, a follower of Wilhelm Reich, describes what might be considered an attempt at synthesis of Reich's vegetotherapy and psychoanalytic theory. A general theory and its application to a variety of disorders is propounded. Impulse originates in the center of the organism, from whence it moves to the periphery, where it has two functions: charging the organism by intake, and discharging, especially through the sex act and reproduction. In man, the upper part of the body, including arms and hands, is devoted to energy intake. Discharge tends to be relegated to the lower half of the body. Consciousness and higher ego functions tend to be set in opposition to the body, from which, however, consciousness obtains its energy. The body is also considered as divided into front and back. The flow of energy along the front of the body represents tender feelings aiming at closeness to others. The source of these feelings is the heart. The back and its hard musculature

is associated with aggression. The source of this aspect of body energy is localized around the insertion of the diaphragmatic crura. Every action has a component of tenderness and aggression. In reaching out one's arms to another person, impulses from front and back are represented. If tenderness predominates, we have an embrace; if aggression, a threat of force. In character disturbances one or the other tends to prevail; e. g., in the oral character, tenderness; in the phallic character, aggression. One energy charges both systems. In the musculature it produces aggression; in soft structures, such as blood and skin, it produces tender, loving feelings. The sexual instinct derives tenderness from the front of the body, aggressivity and thrust from the back. When aggressive and erotic impulses move up to the head, centering on the eyes, we have an ego instinct.

Diagnosis is based not only on word and act but on body structure; e. g., a weak upper body and a well-developed pelvis suggested a child's body sitting on a woman's pelvis, with a concomitant attitude of fearful sexual submission to the male.

Therapy includes verbal analysis and physical therapy. Apparently, at least at times, therapy is conducted with the patient partly or completely nude. This is to be inferred from the author's comments. Physical therapy is directed at releasing muscle spasticities. The how of this is not always spelled out, but it includes having the patient strike the couch, make movements to release tensions in the pelvic girdle, etc. In some cases special exercises to strengthen the legs, and thus reestablish good contact with the ground, are used. The basis of this therapy is Reich's concept (the original Freudian anxiety theory) that if the excess energy of the organism is blocked from discharge and bound by chronic muscular tensions, anxiety is produced. The excess energy of the organism has to be properly discharged by the orgasm.

In this book are innumerable curious juxtapositions of intelligent observation and clinical understanding and wild, free-wheeling theories. Naïve *psychological* concepts of body functioning are not distinguished from physiological concepts. "The brain, too, functions like a condenser, equal in capacity to the condenser-like function of the genital apparatus. The actual amount of energy which can be held and focused in the human brain is tremendous. In very healthy organisms it creates a glow about the head" (page 58). "Bio-energetic" theorizing has a distinctly primary process quality. Metaphors are reified. Unwarranted generalizations made without a scintilla of evidence arouse skepticism; e. g., all masochistic patients are muscle-bound and have the appearance of a gorilla.

There is a certain elusiveness in spelling out the details of the conduct of the physical therapy. A curious error occurs several times. The word *cathexis* is printed *cachexis* (weakness).

The author appears to have sympathy, understanding, and courage for his patients. He presents some scattered clinical material, and the patient's compliant focus on various somatic sensations again demonstrates how our patients will give us what we look for.

In psychotherapy the focus of interest has variously been on the drives, the functioning of the ego, relations with other persons. This book indicates that another possible focus is the body and its muscular tensions. If the wild theorizing were deleted and a more factual emphasis were presented, a book such as this might be of value to psychotherapists in helping to orient them to the nature and quality of their patients' bodily experiences.

JOSEPH KEPICS, M.D.

The Family in Psychotherapy. By C. F. Midelfort, M.D. Price, \$6.50. Pp. 203. McGraw-Hill Book Company, Inc., 330 W. 42d St., New York 36, 1957.

Dr. Midelfort has presented an account of his experiences in treating patients and family groups in the Lutheran Hospital in La Crosse, Wis. Theoretical aspects of his approach are illustrated with case material, including excerpts of interviews and their interpretation. Getting the family involved in the therapeutic effort is frequently facilitated by the custom of having family members remain in the hospital as aides and companions to the patient. This interesting procedure is unique in American hospitals. Discussion could have profitably been devoted to the implications of the therapeutic milieu, but the author chose to focus only on therapist-family-patient interactions.

A basic premise of the work is that the family must be considered as the unit in which illness occurs and that only through melioration of the different psychopathologies in the family can mental health be achieved for any individual member. The author's attempt to offer a conceptual basis for his individual and group-oriented therapy lacks evenness and clarity. He portrays psychiatric disorder as being defects in "love and socialization" capacities. These

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concepts are virtually boundless; so the resulting formulations are poorly defined and nonspecific.

Unfortunately, the case material provides little further clarification of the therapeutic theory or technique. The presentations are abbreviated to the point which makes the author's interpretations seem startlingly arbitrary. Perhaps fewer case illustrations, more completely recorded, would make it easier to understand his technique of family therapy. Several theoretical biases expressed can be challenged simply because they are not presented as theoretical biases but are stated without qualification. For example, the assertion that close body contact between the schizophrenic patient and the therapist conveys love and security seems a bit far-fetched when it is stated as a universally applicable observation.

My impression is that Dr. Midelfort is a confident, capable therapist, who operates effectively and with zeal on an intuitive level. He does not do well in conceptualizing his techniques. If my impression is correct, he is a member of a group of psychotherapists who have attained skill in their art but seem unable to explain it well for the benefit of those of us who are less gifted. The author apparently uses his cultural background and his lifelong familiarity with the social and cultural setting to great therapeutic advantage. He displays a realistic attitude in evaluating therapeutic results and makes no undue claims for his technique.

The basic premise which insists that the family is the unit of psychopathology deserves serious attention and systematic exploration. We can be hopeful that efforts such as this one will be a stimulus to more work in studying and formulating the complexities of family psychodynamics and therapy.

WILLIAM D. WHEAT, M.D.

Person Perception and Interpersonal Behavior. Edited by Renato Tagiure and Luigi Petrullo. Price, \$8.50. Pp. 480. Stanford University Press, Stanford, Calif., 1958.

Since it is through perception that man knows, and so can act in, his physical and social world, the study of perception has properly been of central concern throughout the history of modern psychology. That perception involves more than the simple representation of the attributes of impinging physical stimuli is well known, though variously interpreted. However, both theory and research have been concerned, in the main, with the perception of *things* principally in terms of the relation between the psychologically experienced and the physically measured stimulus attributes. Within recent years, however, systematic attention has been turned to the perception of *persons*, and to the relation between person perception and other aspects of social behavior. Person perception exists, according to Tagiure, whenever "the perceiver regards the object as having a potential of representation and intentionality." Or, as Newcomb states elsewhere in this volume, "humans cognize other humans as being also cognizers." Unlike physical objects, the human as perceptual object perceives back at us! Though the human shares with physical objects stimulus qualities capable of exciting sensory receptors, the observation of another person further involves the inference of such qualities as attitudes, thoughts, emotions, and purposes, which are "visible" but "internal" to the person-as-object. In terms of such inferences we judge the actions of the other and adjust our own behavior accordingly. Since the person-as-object is itself capable of perception and judgment, the perceiver and perceived are involved in a transactional field. The question of "what is the stimulus?" when the object is a person rather than a thing is certainly complex; nor can it be defined in terms of either metric properties or receptor excitation patterns. Person perception always involves the "causal integration" of many cues in terms of the implicit psychological theories of the perceiver, whether naive or sophisticated. Thus, the study of person perception reveals the phenomenal entities in terms of which the perceiver categorizes his social world and so yields clues to the values, meanings, and attitudes of the perceiver himself.

The volume edited by Tagiure and Petrullo consists of a number of pages presented at a Harvard-Office of Naval Research symposium held during March, 1957. The purpose of the meeting was to familiarize the invited participants with each other's work, in the hope that this would contribute to theoretical convergences in a field which has seen the rapid growth of empirical research. Included, in addition to the presented papers, are two classic theoretical papers which spurred development of the area by stressing the active functions of the perceiver and the necessity for phenomenological analysis: R. B. MacLeod's "The Phenomenological Approach to Social Psychology" and Fritz Heider's "Social Perception and Phenomenal Causality." The remaining chapters are scholarly and thoughtful presentations of theory and research, reflecting the informed concerns of active workers. Most describe the findings of a number of studies in ongoing research programs. While many of the individual studies

reported are published, these synthesizing accounts have not, to my knowledge, appeared elsewhere in print. Bibliographies are ample, and the various authors tell their stories in leisurely, yet not overly long, form. Either the participants were unusually self-disciplined in their initial presentations or a fine job of editing was done later; but either way, this symposium is almost unique in the uniformly high quality of the contributions, the avoidance of duplication of the already accessible literature, and the fine balances maintained between brevity and fulness of report and between speculative and empirical material. It is, of course, impossible to describe in any detail the contents of the twenty-three individual chapters which, although reflecting certain common concerns, are addressed to many distinct issues.

Perhaps it is unfortunate that the terms *person* or *social perception* came into use to describe the area covered in this volume. Some would prefer to limit the term "perception" to its traditional connotation or at least, in the present connection, to only one part or phase of the complex process of inference, deduction, induction, and conceptualization involved in the cognition of interpersonal events. Perhaps it is because of the term *perception* that much of the early work in this area focused on the issue of accuracy—the relation between the described and the "actual" characteristics of another, sometimes taken as a measure of the empathic or diagnostic ability of the subject. The logical and methodological problems in such an emphasis are discussed by a number of the authors. In the final chapter, Cronbach makes the ambiguities and difficulties of interpreting dyadic scores evident, while suggesting alternate and methodologically sounder approaches. Another source of confusion lies in the fact that the phrase "social perception" has been used over the past decade or so to describe the influence of factors "within" the subject (social, motivational, and attitudinal) on the perception of nonhuman stimulus objects. So it was found, for example, that hungry, as compared with sated, subjects were more likely to report food objects when asked to describe an unstructured visual stimulus. Only a few of the present studies, notably those reported by Itelson and Slack, actually involve the techniques of the perception laboratory. They use humans (live or representations) as visual stimuli in experiments in which S judges such metric properties as size, shape, or distance. In experiments utilizing aniseikonic lenses, binocular rivalry, and some of the Ames techniques, they find the factors of familiarity and emotional loading, known to be important in perception generally, to be particularly well exemplified.

In his introduction, Tagiure distinguishes the three determinants of person perception: (1) the situation, which serves as a context for the understanding of the other's behavior; (2) the person judged, as he exists apart from the situation (assuming the availability of diagnostic methods transcending the phenomenal experience of the observer), and (3) the perceiver himself, who selectively receives and interprets the evidence at hand in terms of his own internal structure. From the interplay of these factors, the study of interpersonal perception becomes a tool for understanding the structure and effectiveness of groups, the cognitive organization of individuals, and the processes which relate individuals as personalities, such as identification and empathy. Though thus far concerned mainly with the problems of personality and social psychology, it is easy to visualize how the findings and techniques generated could find ready application in research on psychotherapy, psychopathology, and the study of those social processes which have been of concern to social psychiatry.

The emphasis on person perception, as on cognition generally, suggests the misleading generalization that the average person spends his time in social interaction diagnosing the character traits, attitudes, and motives of the other and then fashions his actions accordingly. Even those concerned professionally with human behavior—whether in poker or in psychiatry—only occasionally go through explicit, conscious, and differentiated stages of perception, interpretation, and action. More usually all of us operate in terms of half-formed impressions, minimum information, and implicit inferences, based on largely unconscious referents, though for purposes of research such processes may have to be made explicit and conscious in ratings on variables supplied by the experimenter. Another caution, argued by E. E. Jones and J. W. Thibaut in a fine theoretical paper, comes from the assumption that interpersonal perception not only conditions social interaction but is, in turn, determined by it. The extent and kind of person perception existing in an actual social interplay reflect the structure and purposes of the group or dyadic event (in their scheme considered along the dual dimensions of degree of mutuality and interactional goals). The more contingent the behavior of the one on the other actor, the less the interaction is determined by pre-set rules, the greater the need each has for inferences about the personality and motives of the other.

BOOKS

When in uniform, the conversation between general and private is hardly determined by the perception each has of the dynamics of the other's personality!

SHELDON J. KORCHIN, Ph.D.

The Theory of Psychoanalytic Technique. By Karl Menninger, M.D. Price, \$4.75. Pp. 206. Basic Books, Inc., 59 Fourth Ave., New York 3, 1958.

This is a well-organized presentation of a complex subject, written by an enthusiastic teacher of psychoanalysis. His enthusiasm sets the tone of the book, which is persuasive rather than objective. For the book leaves one with the impression that the author's aim was not so much to examine the theory of psychoanalytic technique as to impress upon the student the meaning of his role, the ethics of his function, and the significance which his personality plays in the psychoanalytic process. He appeals to the student to acquire the proper psychoanalytic "attitude" of patience, objectivity, and sincere respect for the patient's illness, since this—which in this reviewer's opinion must be more than attitude—makes the long stretches of seeming passivity of the psychoanalyst bearable for him and effective for his patient.

The psychoanalytic process begins when the "two-party contract" between patient and therapist becomes effective. The basic rules of the psychoanalytic method—free association, the attentive nonintervention of the analyst, and the (rather overemphasized) fee arrangement—brings about frustrations of the patient's wishes and expectations directed toward the therapist. The oscillations between frustrations and hopes of gratification lead to regression in the patient and bring about transference reactions and transference neurosis. "Characteristic for psychoanalysis is the reduction of regression and transference neurosis by the technique of interpretation alone." Implicit in this statement is the analyst's skill and personality, which enable him to keep the interpersonal dynamics on a level which will make his interpretations effective toward this aim.

Dr. Menninger chose the basic model of the psychoanalytic process to examine the effectiveness of the "two-party contract," i. e., the consistent application of the classical method of psychoanalysis. In doing so, he elucidates several aspects of the regression and the transitory and/or permanent reintegration which occur during analysis. At the same time he is critical of "manipulations" of the transference process. Thus, he does not consider that each response of the analyst to the patient, even his unconscious or involuntary communications, may direct, decrease, or increase the regression of the patient and thus modify the transference. The author thus underplays the participation of the analyst in the analytic process, probably because his aim is to develop "a consistent skeleton of theory and practice." Since for this purpose he has to oversimplify both the theory and the practice, he does not engage in discussion of the practical and theoretical consequences of the reciprocal communication between therapist and patient.

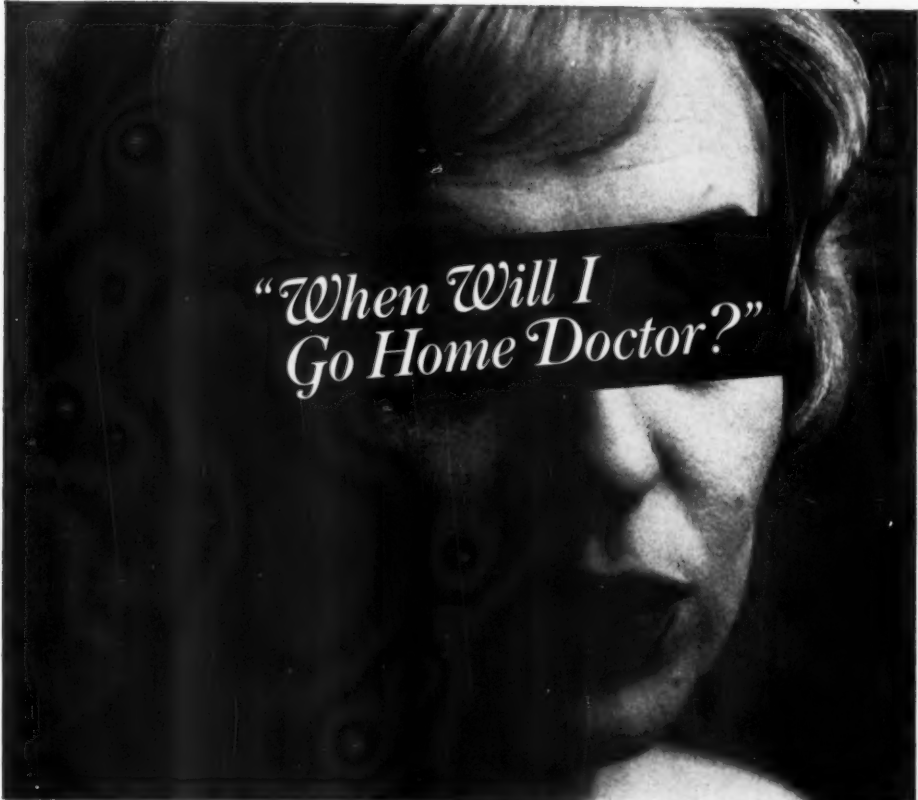
In regard to the theory of the analytic process, the book refers to the sources, stating: "The theory of dream formation, recollection, interpretation is really the basic theory of technique of which all these pages are but an elaboration." The author with justification considered the theory of dream formation and recollection—the basis of psychoanalytic psychology—to be beyond the scope of the present work. The theory of interpretation is, however, another matter. Vague and incomplete as this part of the theory is, Menninger summarizes its main aspects. Interpretation is a process of many phases; there is a hierarchy of therapeutic principles which lead to clarification and interpretation of the unconscious. But the practice of interpretation cannot be formulated by any set of rules, since it has a broad individual range, "depending upon the conceptual model of the personality and the conceptual model of the psychoanalytic process held by the analyst."

The author has not attempted further elaborations of the conceptual model as it may be effected by the current psychoanalytic theory and also by the patient's material, which is quite different from patients of other times and cultures. He concentrates on discussing the ever-changing, yet consistent, frame of the interpersonal dynamic in which the theoretical principles of psychoanalysis become effective and lead to the "working through" of the pathogenic factors in the patient's personality. To elucidate this complex process, Menninger proposes a "theoretical schema," which presents graphically the three continually interacting levels of experiences during analysis. One is the current life situation of the patient; the other is the current experience (transference) in the analysis, and the third is the developmental history. In the first two of these processes the patient relives patterns which were formed during and by the third, by the developmental history. The theoretical schema

"should map the way of the student," so that he may know in each phase of the therapy where he and his patient stand and where to go.

Dr. Menninger found this theoretical schema useful in teaching his students. Whatever objections one may raise, it seems that this schema could be useful to teachers of psychoanalysis, especially to those who study the psychoanalytic process in and through supervision. Thus, while this book has been written for students of psychoanalysis and therefore appears oversimplified for the experienced, it is just this oversimplification and schematic presentation of the psychological dynamics that points so sharply to the need—and possibly also to a method—for research in the therapeutic process.

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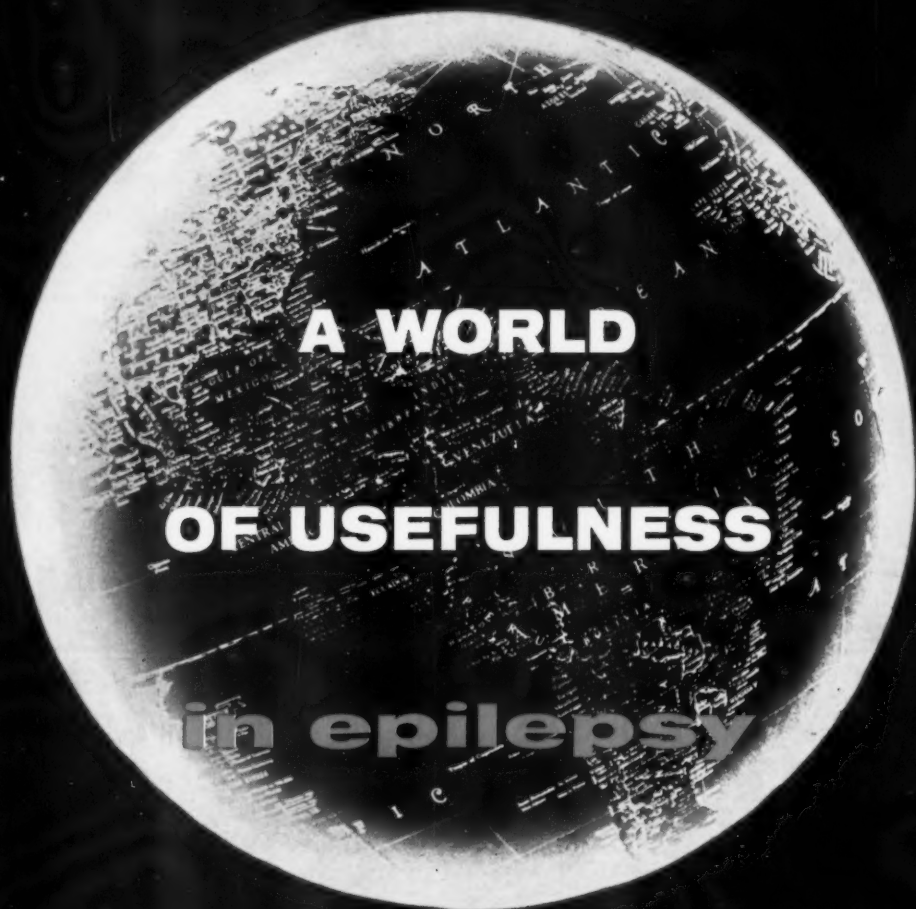
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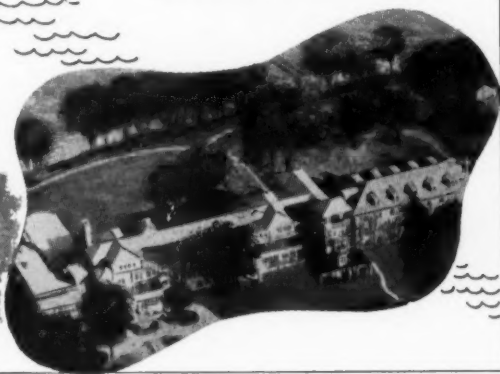
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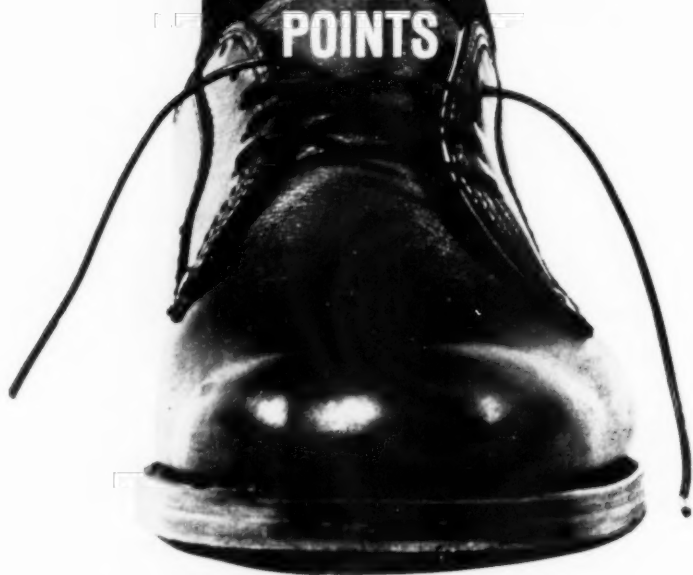
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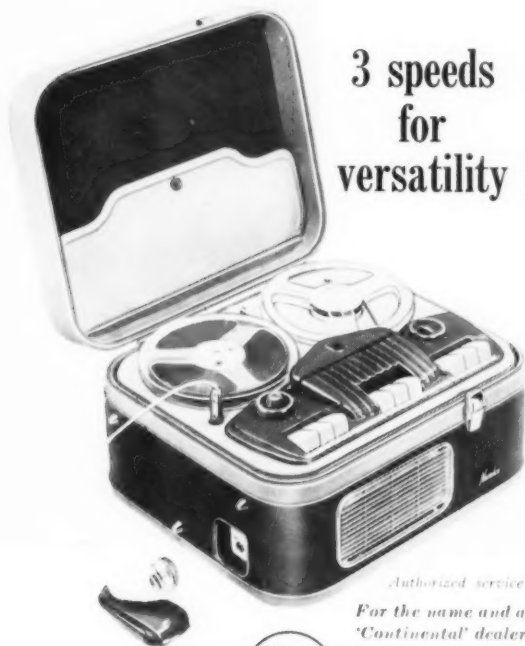


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Because one 'Spansule' capsule sustains an unvarying therapeutic level of 'Compazine' for 10 to 12 hours, 'Compazine' Spansule capsule therapy protects your patient from these sudden falls in drug levels that may lead to a breakthrough of symptoms.

Administered only q12h, 'Compazine' Spansule capsules help you maintain continuous, all-day and all-night control of psychotic behavior.

Available: NEW 75 mg. 'Compazine' Spansule capsules—also in strengths of 10 mg., 15 mg. and 30 mg.

If it's a 'Spansule' brand capsule, it's made and marketed only by

Smith Kline & French Laboratories

first  in sustained release oral medication

*T.M. Reg. U.S. Pat. Off. for prochlorperazine, S.K.F.

†T.M. Reg. U.S. Pat. Off. for sustained release capsules, S.K.F.